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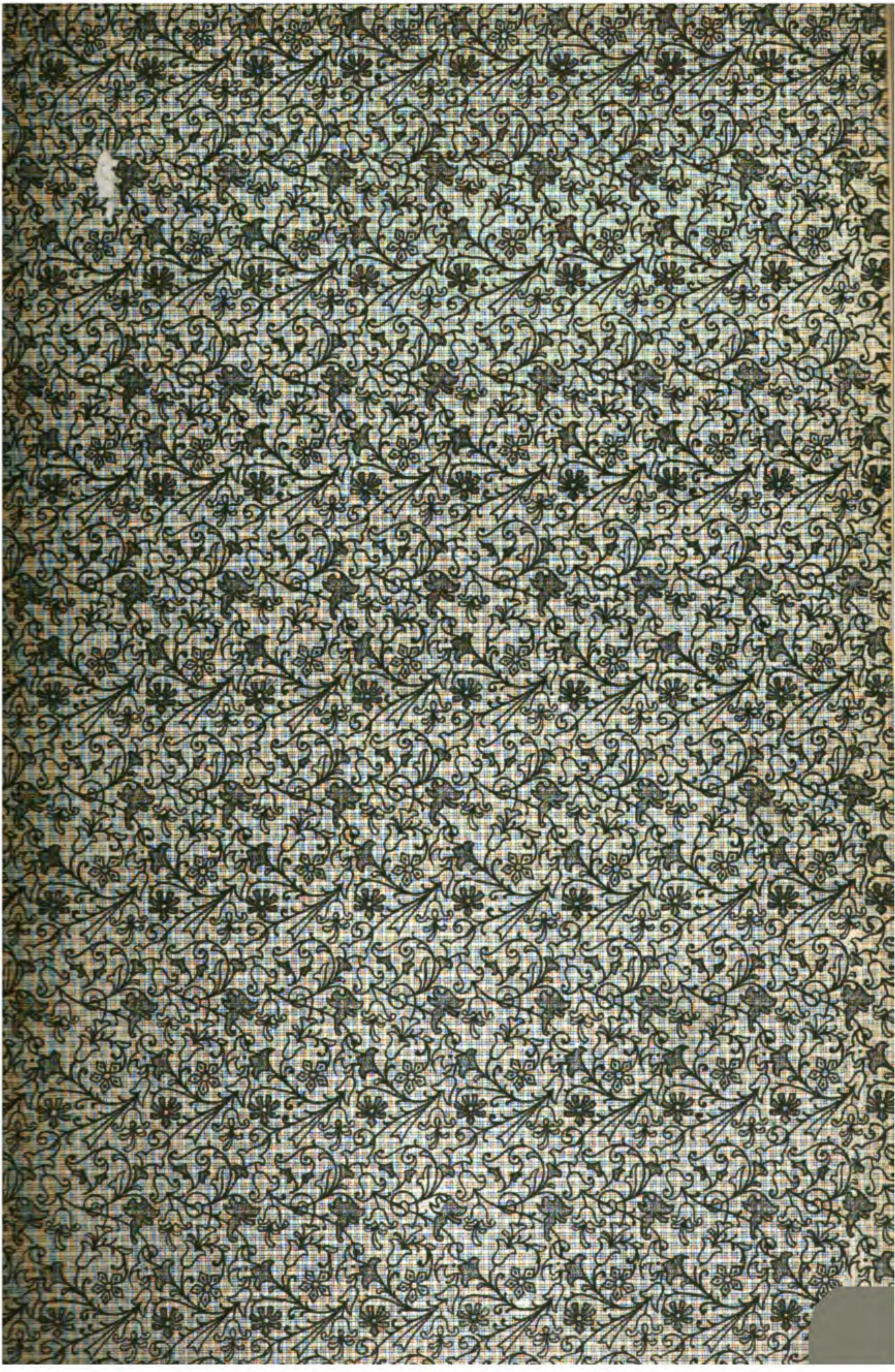

National
Electric Light Association

THIRTY-SIXTH CONVENTION

Commercial Sessions

Papers, Reports and Discussions

CHICAGO, ILL.
JUNE 2-6, 1913

Published by Order of the Executive Committee

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Becker, J. F. *Report of Committee on Membership.* An outline of the methods pursued during the last year in securing members. By various means, a list of 2000 prospects was compiled and a series of four follow-up letters was sent to each. This campaign cost the Section $341.45 and resulted in 120 applications. In addition to this 1000 members of the Association who are not members of the Commercial Section but have requested the proceedings of this Section are being solicited in a similar way. Two recommendations are made by Mr. Becker in order to stimulate membership work. The first is that a prize of $25 should be offered for the member securing the most applications and second that a State chairman of the Membership Committee should be appointed for each State in the Union. These chairmen could work in harmony with the National Membership Committee and would be in closer touch with the prospects in their territory. 11

Burnett, Douglass. *Report of the Publications Committee:* Publications handled 165,930. Booklets by title are "Electric Service in the Home," "Electrical Equipment of the Home," "Industrial Lighting," "Ornamental Street Lighting." Booklets in preparation are: "Home Thoughts Electric," "Store Service," "Church Lighting," "Electricity on the Farm." The publications of the Section have also included the original sets of the Digest and the quarterly issues now current, with binders therefor. This is a Sales Manager's proposition, intimately connected with the new business work of central stations. A certain class of advertising literature is needed and it is felt that this should be prepared by the co-operative efforts of commercial men who know the needs of other men in like positions.

Discussed by Burnett, Gale, Jones, Kennedy, Lee, Lloyd, McMeen, Miller, Osborne, Parker, Seelman, Stagg. 25

Bushnell, S. Morgan. *Report of Committee on Steam Heating.* The report contains the following items. (1) General discussion of the elements which affect the profitableness of central steam-heating plants. (2) Data on the amount of steam required for restaurants and technical purposes. (3) How to popularize the steamheating business. (4) Hot water *versus* steam for heating. (5) Additional suggestions on rates for steam service. (6) Discussion on the availability of exhaust from oil and gas engines for heating buildings. The amount of heat to be secured about 5 per cent of that from the ordinary simple engine. (7) Study of 12 typical curves, showing the relation between the heating load and the electrical load in typical commercial buildings. The utilization of exhaust for heating constitutes a small economy, as compared with the total cost of operating the plant. The small economy secured by using exhaust steam for heating can often be disregarded in order to secure greater economy by the use of large condensing power stations supplemented by independent steam-heating plants for heating limited sections of the commercial district.

Discussed by Bolton, Bushnell, Collier, McCabe, Scherck. 446

Callahan, E. L. *Report of Electrical Salesman's Handbook Committee.* In its report the Committee presents the Electrical Salesman's Handbook, a loose-leaf collection of data on power and abstracts of articles of interest to commerical engineers of member companies. Total data on power installations for the year just closed, 338; abstracts, 64; abstracts and power data on installations for two years just ended, 681. The above data and abstracts cover 175 different classes of business. The data are reliable, having been taken from the practical operation of plants under prevailing conditions. The sheets comprising the Electrical Salesman's Handbook, presented to each Commercial Section member, will lose their value to a considerable extent if the men receiving them do not properly arrange them as indexed and place them in a suitable binder so to be available for ready reference.

Discussed by Callahan, Gale, Jones, Lloyd, Macbeth, Osborne. 37

CROUSE, J. ROBERT. *Report of Advertising Committee.* Definite and specific recommendations are given to member companies in towns of less than 100,000 population, on why, when, where and how they should advertise. The report has been compiled after making careful and personal investigations among the smaller central stations in all parts of the country. It deals with only such advertising campaigns as have proved successful, taking up in succession the selection of an advertising man; the making of the advertising appropriation; the mediums of advertising, under which are discussed the relative values of different newspapers for the advertising of different articles and services; the use of electric signs; the use of the mails, window displays, shows, demonstrations and fairs, theater program and scheme advertising; bill-boards and motion picture screens. The report also discusses in detail "*copy*" to be used for seasonable advertising, and gives outlines of several campaigns, including a house-wiring campaign, the preparation of mailing lists, etc. It further includes a discussion of co-operative electrical advertising, house organs, and the value of Commercial Section literature to the individual advertising of any member company. The report is a recommendation for the consideration of advertising and selling as serious as is ordinarily given to engineering and operation, in the belief that they are quite as important to the profitable operation of a central station.

Discussed by Boynton, Elkhart, Kelly, Lee, McJunkin, Seelman. 98

FORGAN, HON. DAVID R. *Banking and Currency Reform.* The greatest questions of civilization are not financial or political but moral. In this connection the lighting business tends to improve moral conditions since it is well known that well-lighted streets are an insurance against crime and other evils. Our modern business is interdependent and it is through modern systems of credit that interdependence comes. Credit is the backbone of all business activities and in fact 90 per cent of all business is transacted on a credit basis. So-called panics which seem to occur periodically in this country are simply the result of breakdowns in our financial system due to our antiquated banking methods. Attention is called to the banking systems of foreign countries and it is shown that by a centralization of banking power in one institution closely allied with the government, such as the Bank of England, disturbances tending to create panics are quickly alleviated. This centralization of banking power is one of the four pertinent requisites of a modern system for this country; another is more elasticity of currency; another, mobility of bank reserves and a fourth changes in our present system for handling bank assets. Mr. Forgan speaks favorably of the currency reform bill which will shortly come before Congress and urges all members to create a sentiment for further reforms. 14

HALE, ROBERT S. *Report of Committee on Wiring of Existing Buildings.* The report discusses methods of co-operation between central stations and wiring contractors. In general, the report favors central-station soliciting and securing of business, the actual work of construction to be turned over to wiring contractors. This method involves a plan for central-stations to quote definite contractor's prices to customers for small and medium-size jobs. A set of units and specifications, the result of estimates and consultations with members from all over the country, suggests unit costs for different kinds of work and list prices on which a discount of 50 per cent would give an average net cost. The report should form a basis for plans of co-operation between local contractors and central stations, to get old buildings wired at a minimum expense for solicitation and for preliminary cost of estimating and quoting prices. The second part of the report takes up the question of standardizing plugs and receptacles, referred to the Committee late in 1912. Before anything can be done in the way of standardization of plugs and receptacles, it will be necessary for the industry, including the underwriters, to make a sharp distinction between the articles and devices which should be kept off of lamp sockets while on lighting circuits and, on the other hand, should be kept off of both lamp sockets and lighting circuits. This line should be drawn at the same point, so that any device allowed on lighting circuits should be allowed on lamp sockets with a pull plug of some sort, and vice versa, devices too large to be used through lamp sockets should not be allowed on lighting circuits, even if used with a plug and receptacle. The question of whether there shall be two lines of demarcation, one based on lamp sockets and the other on lighting circuits, and at just what number of watts and amperes this line shall be drawn, will have to be settled in conference with the underwriters, and it is recommended that a committee of three be appointed to conclude the matter.

Discussed by Campbell, Donkin, Jones, Lyon, Osborne, Seelman. 268

JONES, GEORGE H. *Report of Committee on Ice and Refrigeration.* The two systems, the compression system and the absorption system, are explained in detail and the various methods of applying each system described. The method of estimating the size of the machine to be used for various purposes is explained, and recommendations given as to the factors to be considered in such calculations. The Committee particularly emphasizes the qualities of the so-called Audiffren type of refrigeration machine recently placed on the market. The Committee considers the practicability of central station service for ice-making to be beyond doubt. These plans generally require the use of between 100,000 and 200,000 kw.-hr. per month, particularly during the summer. The 2000 steam-driven ice plants in the United States would, if operated by central-station service, consume from 600,000,000 to 700,000,000 kw.-hr. per year. The number of electric plants has been increasing steadily. The particular advantages of electricity operated ice plants are that they may be built at or near the center of distribution irrespective of railroad facilities. It is a well established fact that a very large item of cost in the ice business is that of delivery. The ideal arrangement would be to install plants of 80-ton to 100-ton capacity about two miles apart, so that each plant could supply ice for the territory within a radius of a mile, thus reducing delivery to a minimum. The Committee points out that the successful operation of an electrically driven ice plant is primarily dependent upon the equipment installed, an important part of which is the motor drive. In all plants thus far constructed 3-phase alternating current is used. The opinion of the

Committee is that slow-speed, slip-ring, induction type motors and drum controllers should be used. In case constant speed work is desired the resistance of the resistors to be furnished with controller need be large enough simply for starting the motor. The use of multiple-speed motors has been suggested for this class of work, but it is the opinion of the Committee that this practice should be discouraged. The question of superiority in steam and electric plants is answered in the words of one of the largest ice operators in the country, who has a number of distilled ice plants of both types. He states that under his conditions of operation there is practically no difference in the cost of manufacture under the two systems. A particularly valuable feature of this report is an appendix containing a long list of refrigerating plants for various purposes, such as for office buildings, wholesale meat markets, provision dealers, residences, hospitals, packing houses, florists, drug stores, candy factories, groceries, dairies, restaurants, fur stores, hotels and others. In all, 75 plants were specified. For each plant is given the refrigerating equipment of electric motors, refrigerating machines and other particulars which may be of interest.
Discussed by Cochran, Egan, Jones, Lloyd, Porter, Tillman. 364

JONES, T. I. *Report of Committee on Electrical Merchandising.* This report presents a policy and some methods which, it is believed, may be advantageously utilized in the merchandising of electrical appliances. It emphasizes the importance of placing this branch of the business on a merchandising basis and strongly advises that appliances be sold at prices which will produce a profit over all costs. It indicates items which should be included in the cost of doing an appliance business and reports the percentage of overhead charges found in the merchandising of appliances by department stores, contractors, supply houses and central stations. It makes definite recommendations concerning the sale of appliances on installment, and the issuing of appliances on trial. It describes some of the successful plans in use by central stations for increasing the sale of appliances. It touches lightly on the subjects of appliance advertising, repair and delivery. A section of the report is devoted to appliance accounting, in which is recommended a simple system of appliance account and audit.
Discussed by Burnett, DellPlain, Jones, Lloyd, McMicken, Osborne, Seelman, Scherck, Wakeman, Young. 70

LEARNED, JOHN G. *Advertising the Electrical Industry by Means of Reading Matter.* This paper calls attention to the commercial value of publicity along other than advertising lines, analyzes the nature and essential features of such publicity, suggests feasible methods for effective results and submits a particular view of the subject for careful consideration by the Association and the Society for Electrical Development. The author begins by pointing out the general recognition among progressive business men of the value of publicity and shows the relation between it and advertising proper. The human interest side of an industry and its intelligent presentation as the basis of publicity are considered and the theory of effective publicity as an aid to business set forth. The electrical industry's wealth of human interest features, the value of "spontaneous" publicity resulting, and the importance of utilizing other good material now lost are taken up in turn. Here the difference between advertising copy and good publicity material is brought out, the editor's viewpoint analyzed, and the necessity for proper selection and treatment of matter indicated. Recent magazine articles are mentioned as striking examples of intensely interesting stories which are also of immense value to the electrial industry, as similar articles along other lines have aided other big industries. How the Central Stations can co-operate to further the publication and dissemination of such valuable matter is shown and the advantage of such co-operation emphasized. 132

LLOYD, E. W. *Address of Chairman.* An outline of the work of the Section during the year. As a result of the plan of issuing literature to be sold to member companies the commercial section is to-day on a fairly sound financial basis. The commercial papers at this year's convention represent very generally the trend of progress in connection with the commercial side of the electric-service business. It is the intention to broaden the scope of the "Electrical Salesman's Handbook" by including all subjects of interest to electrical salesmen. The work of the committees on Electricity on the Farm and the Wiring of Existing Buildings is commented upon. The latter committee has before it a problem difficult of solution in some localities and there is no subject that should receive greater consideration at the hands of electric-service companies, manufacturers, dealers and contractors. In relation to off-peak business, the subject of using electricity for refrigeration is considered. The load factor of this class of business is 50 per cent or greater, averaging 75 per cent for the months from April to October. During the year there have been added to the Executive Committee of the Commercial Section representatives of the national associations of electrical contractors and electrical supply jobbers. 2

PARKER, JOHN C. *Report on Electricity on the Farm—Committee of Eastern States.* Practically nothing has been accomplished in real extension of electric lines to the rural districts, largely because of the low density of business to be secured, and because of a lack of faith due to extravagant trade literature, combined with the characteristically small dimensions of the Eastern farm. The Committee believes that the intensive nature of agriculture necessary in the East, combined with the possibilities of expensive but sufficiently good distribution systems, makes possible a very attractive seasonally off-peak business, especially for the smaller companies where the peripheral zone is large in proportion to that of the metropolitan organizations. Individual farm applications must of necessity be expensive and rugged, and machines capable of adaptation to a diversity of uses must be kept down to first cost. Technical efficiency of farm installations must be secondary to convenience, ruggedness, and low cost. Equitable preferential power rates are important, but are secondary to installation expense. The problem for each individual central-station company is unique, must be solved by the company itself, and will require initial expense without immediate return, as did the development of the motor vehicle and industrial power business in the cities. The Committee recommends a special man to study and investigate the farm problem, and believes that half-hearted effort will be money thrown away, while vigorous effort combined with a proper advertising program will produce large results.

Discussed by Bass, DellPlain, Edwards, Kelly, Kennedy, Osborne, PenDell, Scherck, Underwood, Wallace. 137

PENDELL, C. W. *Report on Electricity on the Farm—Committee of Middle States.* Data collected upon the application of electrical energy to the work of the farmer show that in practically every daily task there lies the possibility of a motor installation. Cost of production and the time necessary for getting crops upon the market may be reduced to a considerable extent when manual labor is dispensed with as nearly as possible. The data on cost of motor operation in different duties on the farm shed much light upon the idea from the farmer's point of view. Besides farming itself there are other industries common in the rural districts which deserve attention. Chief among these are irrigation and drainage projects, coal mines, stone quarries, brick and tile works and cement plants. Although it is appreciated that all central stations do not have these industries in their territory, each company has some of them or still others more promising. The data gathered by the Committee show that in each of these industries lies an opportunity for an installation of 300 kw. or more. The problem of obtaining the heavy capital investment necessary to acquire farm business may be met in one of several ways. In some communities the farmers have financed local distribution systems of considerable size, taking energy from a cross-country transmission line and retailing it among themselves. In other places farmers have willingly paid the whole or a part of the cost of erecting the distribution circuit. In still other instances the central station companies require a yearly minimum guaranteed income which is commensurate with the cost of the necessary extension. Outdoor substations and copper-clad steel wire are admittedly large factors in reducing the cost of rural extensions. In spite of the various means which have been resorted to in order that a part of the investment cost may be shifted from the central station, it is the opinion of the committee for the Central States that the farming business as developed at present does not furnish returns commensurate with the capital investment.

Discussed by Bass, DellPlain, Edwards, Kelly, Kennedy, Osborne, PenDell, Scherck, Underwood, Wallace. 163

THOMAS, W. A. *Central Station Power in Coal Mines.* This paper discusses a possible field for developing central-station activity in coal-mining work. An analysis is made of the costs in an average isolated plant supplying electric power for coal-mining operations. An endeavor is made to show the general character of load and probable requirements on a tonnage output basis. The construction of central stations mainly for the service of coal mines is conclusive as to the possibility of profitable service of this kind, particularly in combined lighting and power stations so located as to make similar service possible. Particular stress is laid upon a thorough understanding of the mining operations on the part of the central-station solicitor. In like manner it is found that the average mine operator can be dealt with more satisfactorily if he more clearly understands some of the elements of central station operation and why power can be delivered cheaper than he can make it. Complicated rate systems should be avoided, and, above all, frank, open dealing is more conducive to success in handling this problem, very little of which is understood by the average mine operator. A discussion of the various elements upon which a power contract should be based is founded on a study of both coal-mining and central-station problems and the conclusions reached, in the opinion of the author, will, if followed, obviate many of the difficulties experienced by some central stations when first entering this field of activity.

Discussed by Rushmore, Thomas, Thomson. 433

Walton, S. V. *Report on Electricity on the Farm—Committee of Western States.* There is a wide use of electricity for irrigation and other farm purposes in Washington, Oregon and Colorado. The same method of distribution obtains in all three States, there being a primary line feeding energy over the district at 11,000 volts. Previously the practice was to have the customer furnish the transformer and pay for the costs of the line used in reaching him; but now he is asked to pay for the motor only. This has resulted in making electricity popular. From the returns to the questions asked by the Committee it developed that there is a very wide difference in the rates for this service. The irrigation and pumping loads extend from April to October, and the Committee recommends that the smallest installation be made so that it will be required to operate over many hours. In this way the demand is kept down and the load-factor is increased, without any loss in economy of pumping.

Discussed by Bass, DellPlain, Edwards, Kelly, Kennedy, Osborne, PenDell, Scherck, Underwood, Wallace. 150

Williams, George. *Report of Committee on Education of Salesmen.* On the assumption that the central-station salesman is indirectly the means of disposing of manufacturers' products, and that the immense field of new business requires men having all-around training, capable of taking care of a district and meeting intelligently any local conditions without recourse to the home office, the Committee on Education of Salesmen, carried on investigations to bring out the proper qualifications necessary is such a salesman. Eleven general characteristics are specified, and then, by way of elaboration, the Committee quotes passages culled from various sources. One of the first essentials mentioned as a prerequisite is for the salesman to believe he has something which it is right for the customer to use and of which he has need. Other qualifications necessary to success are an effective personality, good humor being a predominant characteristic, and the absence of a continual "grouch"; imagination also to a degree, and absolute honesty in statement. Salesmen need not be purely technical, but they should be loyal to the organization. Many central organizations have established schools for training their employees, and the methods employed in some of these are described at length. Textbooks recommended for study classes by the committee are also enumerated. The books cover a wide range of subjects, but the greater portion have a direct bearing on modern organization, business and salesmanship. To questions asked of representative men in the larger companies the answers indicate that the college man has the advantage over self-trained and self-educated men, that the best organization is secured by promotions from within, that from 75 to 100 per cent of the men employed by manufacturing companies are college graduates, and that from 5 to 15 per cent of the men in the central-station field are also college-bred. The sub-committee to which was referred the question of training by correspondence recommends that a course of instruction be offered to member companies, and that the students should have no financial relation with the Association. The plan of the course is outlined, however, in a very general way only.

Discussed by Beardslee, Einstein, Ferguson, Howlett, Lloyd, Mendenhall, Scherck, Snyder. 44

Witherby, E. E. *The Central Station's Greatest Opportunity—The Electric Vehicle.* The electric vehicle offers an opportunity to the central station that is unsurpassed by that of any other source of revenue which the central station now has. Until every representative of the new business department of the central station begins to realize that in every load of merchandise which passes him in the street there is an opportunity for the sale of electrical energy, he will be overlooking one of the best sources of off-peak revenue which he would be able to secure for his company. The typical load curves shown in the paper well illustrate what is being done by the companies which have already begun to realize the importance of the electric vehicle load. Instances and data cited from the leading express companies and from the largest central stations in the country prove without a doubt that the electric truck is effecting a great saving for both the owner and the company which furnishes the energy. The off-peak character of the electric-vehicle load is mentioned and the load curves of several garages serving both pleasure and commercial vehicles are given. It is a notable fact that practically all of the demand for charging energy is made at times when the demand from all other sources is at its lowest or is rapidly falling off. The practice of boosting at the noon hour is cited as the only way in which the depression in the load curve of the central station which occurs at that time can be filled. Data on commercial vehicles in Chicago show that the number of electric trucks has increased from 80 in the year of 1910 to 647 in May 1913. In closing Mr. Witherby states that, having convinced every live merchant, the large express companies and the entire brewery industry of the economy of the electric truck, it is his hope and the hope of all of the manufacturers that in the near future all central-station men will see the opportunity which is being offered to them and will co-operate in exploiting the electric truck.

Discussed by Beardslee, Blood, Burnett, Gentry, Hale, Jones, Kennedy Lawton, Morgan, Parker, Smith, Tripp, Witherby.

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D. R. Bullen
S. L. Nicholson
H. N. McConnell
M. E. Turner
T. F. Kennedy
J. B. Murray
F. B. Rae
J. C. McQuiston
F. H. Gale

Committee on Steam Heating

S. Morgan Bushnell, Chairman
120 West Adams Street, Chicago, Ill.

A. D. Spencer
Eugene Holcomb
E. F. Tweedy
J. L. Hecht
D. S. Boyden
Thomas Donahue
H. P. Pitts,
C. F. Ohlman

Committee on Advertising

J. Robert Crouse, Chairman
1818 East 45th Street, Cleveland, Ohio

F. H. Gale
J. C. McQuiston

Committee on Education of Salesmen

George Williams, Chairman
60 Wall Street, New York, N. Y.

C. A. S. Howlett
J. A. Britton
R. H. Ballard
H. D. Shute
F. C. Henderschott
John F. Gilchrist
A. Larney
Glenn C. Webster

Committee on Short Cuts in Executing Customers' Orders

George C. Holbertson, Chairman
445 Sutter Street, San Francisco, Cal.

C. S. Walton
C. N. Stannard
B. C. Adams

Commercial Sessions

COMMERCIAL SESSIONS

FIRST COMMERCIAL SESSION—JUNE 3, 2.30 P. M.

1—Address of Chairman of Section. E. W. LLOYD

2—Report of Finance Committee. T. I. JONES

3—Report of Membership Committee. JOSEPH BECKER

4—Address: *"Banking and Currency Reform."* HON. DAVID R. FORGAN

5—Report of Publications Committee. DOUGLASS BURNETT

6—Report of Committee on Electrical Saleman's Handbook. E. L. CALLAHAN

SECOND COMMERCIAL SESSION—JUNE 4, 10 A. M.

1—Report of Committee on Education of Salesmen. GEORGE WILLIAMS

2—Report of Committee on Electrical Merchandising. T. I. JONES

3—Report of Advertising Committee. J. ROBERT CROUSE

4—Paper: *"Advertising the Electrical Industry by Means of Reading Matter."* JOHN G. LEARNED

THIRD COMMERCIAL SESSION—JUNE 5, 10 A. M.

1—Report of Committee on Electricity in Rural Districts. JOHN C. PARKER, S. V. WALTON AND C. W. PENDELL

2—Report of Committee on Wiring of Existing Buildings. R. S. HALE

3—Paper: *"The Central Station's Greatest Opportunity — the Electric Vehicle."* E. E. WITHERBY

FOURTH COMMERCIAL SESSION—JUNE 5, 2.30 P. M.

1—Report of Committee on Refrigeration. G. H. Jones

2—Paper: *"Central-Station Power in Coal Mines."* W. A. Thomas

3—Report of Committee on Steam Heating. S. Morgan Bushnell

4—Report of Nominating Committee

5—Election of Commercial Section Officers

FIRST COMMERCIAL SESSION

TUESDAY, JUNE 3

THE CHAIRMAN, PRESIDENT TAIT: Gentlemen, let us have this meeting come to order, please. The first number on the program this afternoon is an address by your chairman, Mr. Edward W. Lloyd, of Chicago.

ADDRESS OF THE CHAIRMAN OF THE SECTION

We are now at the close of the third year of the Commercial Section. While many of our members interested in the sales department of the Section business have appreciated the desirability of organizing, few, if any, have realized the large amount of work and money necessary in order to place the Section on its feet.

During the first half of this period one of the problems was to secure sufficient members to support the Section. This was not entirely accomplished and it was necessary to call on the main body for financial assistance, the annual dues of $2.50 per member not being sufficient to take care of the expenses.

During the year 1911, your Executive Committee formulated the plan of issuing booklets on Street Posts, Sign Lighting, Electricity in the Home, etc. These were well received and sold to member companies for distribution to their customers and prospects. It is due to this plan that the Commercial Section is to-day on a fairly sound financial basis. During the past year new publications have been compiled and are now ready for distribution.

The amount of work accomplished by your Publications Committee is not entirely shown in the Report to be presented to you. The detail work necessary in getting up the booklets issued has been very great and has made a serious call on the time of the members of this Committee, as well as on those in Association Headquarters who had to do with the work.

The finances of the Section will be presented in the Report of the Finance Committee. It is sufficient to say that the annual dues do not cover the cost of the matter received by each Section member, the quarterly digest alone costing more than this sum. All members of the Commercial Section in good standing are entitled to one copy of each piece of literature issued by the Section.

It is only fair to call attention to the loyal and earnest support your Chairman has had from the Executive Committee and members of the several sub-committees. These men have devoted many hours of their time to the work of compiling information, and their reports should receive your earnest attention. The papers to be presented at this year's Convention represent very accurately the trend of thought, work and progress in connection with the commercial side of our business.

Your Membership Committee has stimulated interest in the Commercial Section by a mail advertising campaign. It was our thought that it would be better to demonstrate that the good to be obtained from membership in the Section was far greater than the amount of the annual dues, and, by so doing, we would have no difficulty in securing members.

Those of the Commercial Section who have supported it from the beginning deserve all credit and we hope to secure their continued support by delivering something worth while to them. In this connection, the Electrical Salesman's Handbook, issued quarterly, contains an amount of data that it is practically impossible to secure from any other source. While the subject of power has received the major portion of this Committee's attention, it is intended to broaden the scope of the Handbook by including information on all subjects of interest to salesmen.

The *Quarterly* is a continuation of the work started by the Electrical Solicitor's Handbook, which was issued in ten editions from 1909 to 1912. The valuable information contained in the older book has had very wide circulation, and it is the intention of your Executive Committee to issue matter along similar lines from time to time in the *Quarterly*.

In conection with the Report of the three Committees on Electricity on the Farm, it is to be noted that this subject has stirred up much interest, and companies having heretofore no thought of running lines outside of cities are now making extensions into rural districts. This problem requires different handling in different sections of the country, but the possibilities are so great that every central-station man should look about him to discover what can be done in his territory.

In the Report of the Committee on the Wiring of Existing Buildings we have a very live subject, especially in the Eastern and Middle West cities, where there are thousands of unwired houses, the cost of wiring these houses being, in many instances, so high as to make the problem difficult of solution. There is no subject that should receive greater consideration from our companies to-day. Not only are the central stations vitally interested in the problem, but manufacturers, supply dealers and contractors also. A home once wired means a prospect for the use of electricity-consuming devices for years to come.

Recently the possibility of increased revenue, due to the securing of off-peak or limited-hour service business, has had special attention from many central-station operators. In some cities the sale of electricity for refrigerating purposes has assumed quite large proportions, and in a few communities the successful manufacture of ice from central-station power is large enough to make this business worthy of the consideration of every company, particularly when we remember that in this latitude the load-factor is 50 per cent, or better, and that it averages 75 per cent for the months from April to October. The report of this year's Committee gives some very valuable data relative to the subject, and should be interesting to everyone who is in a position to take off-peak business.

Along the same lines is the Report of the Electric Vehicle Committee. The sale of electric vehicles, according to our manufacturing friends, has increased at a tremendous rate during the last year, but by no means at the rate that it deserves, in view of the high efficiency of this method of transportation. The electric vehicle is doing all that its best friends claim for it and the possibilities of income to central stations through its use are so great as to be almost beyond calculation. Many central-station companies are not alive to the value of this business and some of our member companies, to their own disadvantage, do not themselves use this method of transportation. This is not as it should be. This vehicle is far beyond the experimental stage and is here to stay.

The Report of the Steam Heating Committee is one that usually interests a small proportion of our membership only; but, nevertheless, the problems arising from the necessity of furnishing steam under certain conditions are such that we considered it advisable to have still another report from the Committee. This year's Report is fully as valuable as that of last year, the information contained therein being along somewhat different lines. The diagrams showing the time of steam demands, as compared with the hourly demands of electricity during the heating season, should interest all commercial engineers.

The Committee on Advertising present, this year, a Report giving advertising data for the guidance of small central stations. This sort of information is difficult to secure, particularly so for the small station operator, who cannot afford to employ a high-priced advertising manager.

The Report of your Committee on the Education of Salesmen is a new departure so far as the Commercial Section is concerned. The difficulty of securing competent men for the different branches of the sales department is well known. Most central-station companies to-day are educating their own men in a more or less haphazard manner. The time is coming, if it has not already arrived, when the old methods will not do. Salesmen for central-station companies should be all that the name implies. We need trained men for the several branches of our business if we are to secure larger and more important classes of business. In this connection, the salesmen handling the larger prospects require some engineering training. In addition, they should have a knowledge of all the principles of salesmanship. So far as I know, there are, at present, no schools turning out men of this class, and it is, therefore, necessary that some definite method of training be applied in order that we secure men of higher grade. Lighting, sign and appliance salesmen are required to know more to-day than ever before.

The publicity recently given to illuminating engineering has awakened the public to the value of this science as applied to their business, and the successful central-station salesman handling this class of work will be out of the running if he fails to acquire proper knowledge.

This year there have been added to your Executive Committee representatives of the National Contractors' Association and the Jobbers' Association. These representatives have assisted the Executive Committee in carrying out the work assigned to it and we feel that the addition of these gentlemen to our ranks has been a move in the right direction and hope that the good feeling established will continue.

Our manufacturing friends have also contributed their full share to the work of the year, in many ways.

The Executive Committee of the Section has adopted a new button for the use of members, which can be secured at Commercial Section headquarters in this building.

In closing, I want to take this opportunity of thanking all those who have contributed to the Commercial program and to other work accomplished this year. This hearty co-operation has resulted in a program that we hope will meet with your approval. The Commercial Section is here to stay and every man interested in sales and in the business generally, if not already a member, should make it a point to join before leaving the Convention.

Our slogan should be:

THE MORE MEMBERS THE MORE VALUE TO
EACH MEMBER

THE CHAIRMAN: You have heard the address of your chairman, gentlemen, what is your wish in the matter?

MR. E. C. SCOBELL, Rochester: I move you, Mr. Chairman, that the Report be referred to a committee in the usual way.

(The motion was seconded and carried.)

THE CHAIRMAN: With your permission, gentlemen, I would like to turn the meeting over to your very able chairman, Mr. Lloyd.

THE CHAIRMAN, MR. LLOYD: The next number on the program is the Report of the Finance Committee, Mr. T. I. Jones, of Brooklyn, N. Y., Chairman.

REPORT OF THE COMMERCIAL SECTION FINANCE COMMITTEE

The work of the Finance Committee for the past year has principally been to put into force a definite system of bookkeeping whereby the expenses and revenues of the Section may be kept distinct and separate from the expenses and revenues of the Association as a whole.

To this end a budget was prepared at the beginning of the year, covering the estimated amount of expenditures and revenue for the year 1913, and income and expense accounts charged to stated items in this budget. The estimated amounts for the year 1913, as against the actual amounts spent, are shown on the last page of the report. In connection with the estimated revenue from Sale of Publications budget, a large number of copies of the old publications were charged off as unsalable, but it is of interest to note that many copies were sold, with the revenue shown in the Budget report.

The expenses of the Section for the year 1913 followed very closely the budget estimate. While we estimated for the Salesman's Handbook a cost of $2,200 for the year, we have already expended $2,400 during 1913, but this is due to the fact that the data sheets for the last issue were double in number those of its predecessors, and it is quite probable that the remaining issue will be reduced in volume and correspondingly lowered in cost.

The Report for the first four months of the fiscal year 1913 shows that the total revenue amounted to $5,241.78. Of this amount, $2,895 was from dues and $2,346.78 from sale of publications.

The total expense amounted to $4.755.41. Of this amount, $813.64 was for running expense and $3,941.77 was the cost of publications.

The surplus for the period was $480.37, which, added to the adjusted surplus as at the first of the year, namely, $16.19, gives a surplus at April 30, 1913, of $502.56.

The amount due from dues was $1,289.15, and from publications $1,219.82, making the total Accounts Receivable at April 30, 1913, $2,508.97. The Accounts Payable at April 30, 1913, was $1,287.95.

Owing to the fact that the parent body makes all its Financial Reports according to the calendar year, this report is made to date only for the year 1913. A detailed report for the last half of the year 1912 will be supplied to any of the members who may wish to see it.

COMMERCIAL SECTION
OF THE
NATIONAL ELECTRIC LIGHT ASSOCIATION

BALANCE SHEET

AS AT APRIL 30, 1913

Assets Side		
Furniture and fixtures		$ 290.91
Inventory of Publications:		
Value of publications on hand April 30, 1913		102.14
Accounts Receivable:		
Fixed dues, year 1912	$ 206.65	
Fixed dues, year 1913	1,082.50	
Total	$1,289.15	
Publications	1,219.82	
		2,508.97
Total		$2,902.02

Liabilities Side	
Accounts payable	$1,287.95
National Electric Light Association	1,111.51
Total liabilities	$2,399.46
Surplus	502.56
Total	$2,902.02

PROFIT AND LOSS ACCOUNT

FOUR MONTHS TO APRIL 30, 1913

1912. Dec. 31.	Balance to the credit of account		$1,518.48
	Less Deductions as follows:		
	Depreciation 1912 publications as follows		
	1638 copies "Digest"	$ 562.90	
	5000 " "Elec. Equip. of the Home"	200.00	
	3000 " "Industrial Lighting"	180.00	
	2500 " "Ornamental Street Lighting"	500.00	
		$1,442.90	
	Bill of National Quality Lamp Division for expenses in connection with membership campaign, years 1911 and 1912	59.39	
			1,502.29
1912. Dec. 31.	Corrected balance to the credit of account		16.19
1913. Apr. 30.	Surplus for four months ended April 30, 1913, as per "Income Account"		486.37
	Balance to the credit of account		$502.56

INCOME ACCOUNT

FOUR MONTHS, ENDED APRIL 30, 1913

EXPENSES

Running Expenses:		
Salaries and wages	$413.00	
Expressage and messenger	30.90	
Postage, telegrams and telephones	23.59	
Printing and stationery	152.75	
Membership Campaign Ex.	48.20	
Uncollectable Bills	8.20	
Miscellaneous Running Expenses	137.00	$813.64
Cost of Publications (Less Inventory)		
"Industrial Lighting'	$ 96.66	
"Ornamental Street Lighting"	5.00	
"Electric Service in the Home"	952.67	
'Electrical Salesman's Hand Book"	2,429.92	
"Electrical Salesman's Binder"	145.45	
"Electrical Equip- of the Home"	150.32	
"Home Thoughts Electric"*	161.75	3,941.77
Total expenses		$4,755.41
Surplus for 4 months, ended April, 30, 1913		486.37
		$5,241.78

REVENUES

Revenue from Fixed Dues

No. of Members		Amount of Dues
1,102	First of year	$2,755.00
147	New members	367.50
1,249		$3,122.50
91	Resignations	227.50
1,158	April 30, 1913	$2,895.00

Revenue from Sale of Publications.

No of Copies		
1,000	"Industrial Lighting"	$100.40
180	"Industrial Lighting"	gratis
1,324	"Ornamental Street Lighting"	79.95
183	"Ornamental Street Lighting"	gratis
57,104	"Electric Service in the Home"	1,698.95
229	"Electric Service in the Home"	gratis
4,599	"Electrical Equipment of the Home"	207.40
179	"Electrical Equipment of the Home"	gratis
1,183	"Electrical Salesman's Hand Book," 1st quarter	gratis
1.183	"Electrical Salesman's Hand Book," 2nd quarter	gratis
1	"Electrical Salesman's Hand Book," 2nd quarter	.75
687	"Electrical Salesman's Hand Book," 3rd quarter	gratis
18	"Electrical Salesman's Hand Book," complete	45.00
260	"Electrical Salesman's Binders"	194.08
170	"Home Thoughts Electric"	.70
14	"Home Thoughts Electric"	gratis
	"Miscell. Rev."	19.55
		2,346.78
	Total Revenues	$5,241.78
		$5,241.78

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* Represents bill for preliminary expenses. Bill for printing not yet received.

Respectfully submitted,

Committee { T. I. JONES, *Chairman* F. H. GALE
{ P. S. DODD J. C. McQUISTON

MR. JONES (continuing): Mr. Chairman, with your permission, I would like to say just a few words in addition to this. As to the revenues of the Section, it has not been necessary for us to go to other sources for contributions. When the Section was first formed, it was necessary to get additional revenue, but during the present commercial year this has not been necessary. The Section has made a material profit on the sale of these publications and it derives an income in that way. It is pertinent to call your attention to these publications in order that the members of the Section may appreciate the value of them, not only to themselves in the advancement of business, but in the interest of the development of the Section, as a whole. It is of the greatest importance.

THE CHAIRMAN: I do not know as there is anything much to add to what Mr. Jones has said, excepting to emphasize the hard work we have had in reaching the position we are in to-day. We are a few dollars to the good, and the Section is on its feet. Now, we want to turn over to our members literature that they cannot get along without.

THE CHAIRMAN, MR. LLOYD: The next number on the program is the Report of the Commercial Section Membership Committee, Mr. J. F. Becker, Chairman.

REPORT OF THE COMMERCIAL SECTION MEMBERSHIP COMMITTEE

Your Membership Committee has on hand a prospect list of approximately 2000 names of active commercial men in the central stations and allied interests, which have been furnished by committeemen of the Commercial Section. To this list we have mailed and completely distributed four follow-up letters, together with circulars, outlining the advantages of membership in the Commercial Section, and to date a total of 120 applications have been received through the efforts of the Committee. The cost of this campaign was as follows:

8000	(2000 each) follow-up letters	$16.00
8000	Commercial section letterheads	32.00
2500	Booklets (J. C. McQuiston)	23.00
2000	Inserts on Commercial Section Publications	5.75
8000	Application blanks	24.00
8000	2-cent stamps	160.00
	Additional expenses	75.00
	Total	$335.75

We have an additional list furnished us by the Home Office, consisting of 1000 names of members who have requested the proceedings of the Commercial Section at the last Convention. This list will eventually be compiled in our prospect file and additional letters and matter forwarded, pointing out the advantages of membership in the Commercial Section.

The Membership Committee has been authorized to offer a prize, not to exceed $25 in value, to the individual securing the greatest number of applications by June 2, 1913.

The Committee has compiled, through the courtesy of Mr. J. C. McQuiston, a list of all active committees for 1913, together with all the active members. This list has been printed in an attractive form and distributed among the Class A and E members companies, with a letter requesting the managers to note the absence of names of any members of their commercial departments, and to forward corrected lists to the undersigned for the purpose of completing the list of prospects. This list has numerous omissions and errors and is to be revised annually. Any corrections should be forwarded to the Chairman of the Membership Committee for his notation.

Arrangements have been made by the Committee for an active campaign on the trains to the Convention as scheduled by the Transportation Committee, and a member of the Committee will be in attendance at the Commercial Section booth during the Convention.

The active membership of the Commercial Section in 1912 was 913 members; 482 new members have been added since with a total of 173 resignations, making a net total at the present time of 1222 active members. It is the feeling of the Membership Committee that more active work and better results could be obtained by enlarging the body, and we recommend that a State Chairman of Membership be appointed for each State in the Union, together with the various Provinces in Canada, to concentrate effort. This suggestion does not mean doing away with the general Membership Committee, but will strengthen it by the addition in each State of a Chairman having active jurisdiction in territory well known to him.

Instead of the follow-up letter method pursued by the present Committee, it is recommended that an attractive folder be prepared outlining the advantages of membership in the Commercial Section.

It is further recommended that an additional cash prize of $25 be offered to the individual securing the greatest number of new members for the Commercial Section by January 1, 1914.

The Membership Committee has devised a distinctive button which can be purchased by members of the Commercial Section at a nominal price. These will be on sale at the Commercial Section booth, Exhibition Hall, during the Convention.

Respectfully submitted,

Committee

J. F. Becker, *Chairman*
P. S. Dodd
Parker H. Kemble
S. M. Kennedy
S. V. Walton
L. R. Wallis
C. A. Littlefield
C. N. Stannard
Morton Ramsdell
W. R. Collier
F. D. Pembleton
W. A. Donkin
F. D. Beardslee
M. C. Rypinski
J. R. Crouse
G. B. Griffin
H. S. Wells
George Williams

MR. SAMUEL INSULL, Chicago: My friends, Mr. Lloyd asked me to present the next speaker to you. I do not know that there is any subject more important to us central-station people than the relation of business to financial conditions. We are in a business which takes a vast amount of capital. Capital is essential to the success of our business, and it is essential that that capital should be raised at the lowest possible cost to the business. Owing to the fact that our business has not reached a point of saturation, it seldom occurs that we are able to check our expenditures at times of general business depression, when other lines of business naturally contract, owing to financial conditions. Any money that has to be raised in times of financial disturbance must be raised at a great cost to our business, so that interest in this subject must be of a special character, and, I am sure that we shall learn a great deal by listening to our friend, Mr. David R. Forgan, president of the National City Bank of this City, who is to address us.

BANKING AND CURRENCY REFORM

Gentlemen of the National Electric Light Association: I regard it as a privilege to address the representatives of a calling whose happy lot it is to enlighten the earth. The greatest problems of mankind are not financial or social, but moral. Your calling is always on the side of righteousness, for there is no greater enemy of vice or crime or crookedness than the pure protecting light which it is your business to cause to shine in our city streets. Darkness and its deeds flee from it. Beauty and cleanliness accompany it. Enterprise and prosperity follow it.

I sincerely congratulate you, gentlemen, on your good fortune to be engaged in a business which is, in itself, beneficial to mankind in the highest degree, and which is growing in importance and magnitude with every day's setting sun. It may seem at first glance that there is no special connection between your business and the subject on which I am to address you—Banking and Currency Reform. But there is. All business nowadays is interdependent.

Now, there is no one better qualified to see the interdependence of all lines of business upon each other than the banker. The life-blood of modern business is credit, and the banks are the heart which controls and distributes it. Modern financial ramifications are so intricate that all civilized countries are really bound together by invisible cords of mutual interest. This fact has become one of the greatest guarantees for peace between the great commercial nations. The great bankers have now more to say as to whether a country shall go to war than the kings or emperors; and these credit ramifications get down to the most minute and personal relations between man and man. For example: Not long ago a man came to my office looking a little pale. He said: "Mr. Forgan, you probably don't know it, but I have a bad boy. I have not heard from him in seven years, and did not know whether he was living or dead, but to-day I got a letter." It was from the middle of Africa; he was sick, and, like the prodigal son of old, who was in a far country and sick, he had thought of his father and had written home for help, and his father, with quivering lip, said: "How soon can you pay some money to that sick boy?" I said: "Is there a bank there?" He examined the letter, and we found that there was a branch of a London bank there. I said: "We will pay it this afternoon;" and we did. The whole world is bound together by the invisible cords of mutual interest through the functions of credit.

If time permitted, I could go on to show you how the place and potency of credit in modern business affects every one, from the highest to the lowest in the land. But I have said enough to indicate the thought, and to make it unnecessary for me to apologize for asking your attention to-day to a strictly financial question, namely: the reform of our currency and banking system.

Mr. Carnegie once made the statement that the banking system of the United States was the worst in the world. After many years' experience of it, compared with the systems of two other countries in which I have had the fortune to be a banker, I am ready to agree with him. Mark you, he did not say that the banks in the United States are the worst in the world. Far from it! I think the banks in the United States, on the whole, are the best in the world. In the State from which I come, for example, only ten national banks have failed in the last thirty-one years. Of those ten, eight paid their depositors in full, and the other two came so near to doing so that the total loss to depositors was $13,000. When some of you who are fond of mathematics have nothing else to do, you may amuse yourselves by figuring out what an infinitesimal proportion of 1 per cent per annum on the deposits of the national banks of Illinois that amounts to. It would take so many decimals that I will not attempt to state it. So far as Illinois is concerned, it is certainly not in need of any State guarantee of bank deposits. No national-bank depositor in that State has lost a cent in fourteen years. The banks in this country, as a rule, are well managed, well manned, and in normal times deserve and enjoy the confidence of their various communities. It is only the system, or the relation of one bank to all the rest, that is at fault. Perhaps it would be nearer right to say what is at fault is that there is no system, because the moment trouble threatens in this country each of the 25,000 or more banks becomes a unit, standing by and for itself, seeking to increase its own little hoard of reserves and so isolated that it can neither give help to nor get assistance from its neighbors.

Speaking financially, the national disgrace of this country is that, containing the greatest natural resources of any of the civilized countries, and numbering among its people the ablest business men in the world, blessed with a prosperity the like of which history has never known, and fortified by the possession of more gold than all of its chief competitors combined—I say, the national disgrace is that, in spite of all of these advantages, it is the only country visited by periodical financial panics. No other civilized country within the memory of living man has had a panic causing general suspension on the part of its banks, while this country has had about a half-dozen. Four years ago financial stringency existed all over the world. Only in the United States was there suspension of specie payments on the part of the banks. Our panics are always limited sharply by our national borders. In 1893 and 1907 I could have taken you to some places in this country, separated from Canada only by a bridge, where at one end of the bridge there was panic and suspension, and at the other end, confidence and normal conditions. Even our southern neighbor, Mexico, knew no panic.

Now, we have talked about this thing for many years, but as a nation we have done nothing. We have been like the farmer, the hole in whose barn roof was never mended, because when it was raining he couldn't mend it, and when it was fair it required no mending. Our conduct in this regard reminds me of the Irish servant girl who announced to her mistress that she was going to be married, but although a big Irishman was seen to frequent the kitchen, time passed and Bridget remained in her place. Finally her mistress asked her what the trouble was. "Oh, sure, ma'am, I don't think I will get married at all," was Bridget's reply. "But what is the reason?" asked her mistress. "Well, ma'am," said Bridget, "it's this way: When Pat is sober he won't marry me, and when he is drunk I won't marry him." That is the way we have treated this question, until about three years ago, when the Government appointed the National Monetary Commission for the purpose of visiting other leading commercial nations, studying their banking and currency systems, and discovering what it is that they have and we lack which enables them to avoid a threatened panic, while everything that we try to do when a panic threatens seems only to bring it the quicker upon us.

There are four attributes present in other banking systems and lacking in ours which seem to me to cover fundamental principles involved.

ELASTICITY OF CURRENCY

Our banking currency, being secured by Government bonds, is rigid. It neither expands nor contracts with the changing needs of the different seasons or sections. In our currency a gold dollar never counts for more than a dollar. In Germany, for example, a gold dollar is sufficient basis for the issue of three dollars of currency, the gold in the Reichsbank being merely a reserve of 33 1/3 per cent against its currency liability, just as our national banks must keep certain reserves against deposit liabilities. In other words, note issues are one-third gold-secured and two-thirds asset-secured in Germany. Other countries have similar, but varying means of ready note issues, thus providing the elasticity to meet a crisis which our currency absolutely lacks. Bankers in 1907 had to invest in 2 per cent Government bonds at an absurd price before they could get additional currency—in some cases as high as 109—and all who remember the certificates of small denominations then issued by the clearing-houses as a substitute for money, can fully appreciate this lack of elasticity in our currency.

MOBILITY OF BANK RESERVES

When financial trouble threatens in this country, our reserves scatter. In other countries they are massed and can be used where most needed. Our banks have no system by which they can stand together and benefit from the strength which is in union. They are isolated units, and, following a natural law, they seek to strengthen themselves, which can be done only by weakening their neighbors. The centers are placed at the mercy of the country banks by the system which permits balances due the latter to be counted as part of their legal reserves. Every banker naturally wishes to strengthen his cash on hand in stormy times, and the drain on the central reserve cities, therefore, culminates at the very time they are least able to meet it. Their only resource is to call loans—especially stock exchange loans—

and the result is falling stock markets, liquidation, general curtailment of credit functions and finally, panic.

For example, we will say that the First National Bank of Peoria has a million dollars of deposits, and, speaking in round numbers, it has by law to keep 15 per cent legal reserves. Three-fifths of that 15 per cent, or 9 per cent, may be kept in the First National Bank of Chicago, or any other national bank in Chicago; so that the First National Bank of Peoria in normal times, we will say, has $60,000, or 6 per cent, in its safe, and $90,000, or 9 per cent, in the First National Bank of Chicago. One morning the president picks up the paper at the breakfast table and learns that something terrible has happened in Chicago; some Scotchman that has been running a bank there in Chicago has gone off home, or something else that alarms him has taken place; and he comes down, and the first thing he says is: "Mr. Cashier, I do not like the look of things in Chicago this morning. How much money have we got there?" "Ninety thousand dollars." "How much have you in the safe?" "Sixty thousand." "Well, I do not want to disturb them, but I should like to have a little more money at home." That is all very well naturally, and we would all do the same thing, and so he says: "Telegraph them for $20,000." Now, if the First National Bank of Chicago had $90,000 in gold, or legal tender, in its safe marked with the name "First National Bank of Peoria," then the First National Bank of Peoria would have $90,000 in reserves in the city of Chicago; but it has nothing of the sort, as you very well know; it has merely a credit on its books of $90,000, against which it keeps a reserve of $20,000, and when the First National Bank of Peoria calls for $20,000, and the First National Bank of Chicago sends it to them, they have sent all the reserve there is in the world, pertaining to the deposit of the Peoria bank, outside of its own safe, and the First National Bank of Chicago is left with $70,000 deposit liability against which it has no reserve. All that the Peoria bank has done is to increase its reserve in its safe 2 per cent; and what happens in Peoria happens in Podunk; and consequently all we have to do in this country is to have what we call the "country banker" a little bit alarmed and deciding that he would sleep a little bit sounder to-night if he had 2 per cent more reserve in his safe, and you clean out practically all the reserves in the centers.

LIQUIDITY OF BANK ASSETS

In countries where the banking system is dominated by a central bank with powers of note issue, other banks have a place where they can rediscount their short-time paper and get currency. The note-issuing power of the central institution enables it to take care of an enormous amount of such business. In addition to that, if a prime discount market be established by allowing banks to accept time bills of exchange, another source of rapid liquidation of bank assets is available. If a bank has invested in these prime bills to-day and requires the money again to-morrow, it can get it by simply rediscounting the prime bills. When distress exists in any financial center, the rate of discount on such bills rises and attracts money from other and even foreign financial centers. All this is unknown to American banking. When an American bank invests in a time obligation, it locks it away until the day of maturity. It is true that smaller banks frequently call upon the larger ones to rediscount for them, but so unpopular has this natural and proper transaction become that the borrowing bank usually tries to arrange such accommodations in a way that cannot be strictly called rediscounting. In this country there is no discount market, and no central organization through which an American bank, in case of need, can quickly liquidate its short-time investments without loss of standing, or the more or less humiliating process of "asking a favor."

CENTRALIZATION OF BANKING POWER CLOSELY ALLIED TO THE GOVERNMENT

One requires a very little knowledge of finance to appreciate the tranquilizing power that may be exerted in trying times by a dominating bank closely allied to the Government. When the Bank of England or the Bank of France comes to the rescue of an institution or a situation, the mere report is enough to stop an incipient panic. All the other banks follow its lead, and crises can be met and overcome by such united action before the people know that danger has threatened. Panic is fear without real cause. It cannot hold sway in the minds of the people after they know that their great national bank, backed by their national government, has undertaken to care for the situation.

These are the four chief attributes of sound banking that are enjoyed by all the leading countries of the world, except the United States. To supply them, without radically changing the present system, was the colossal task assigned to the National Monetary Commission. Its chairman, Senator Aldrich, after years of profound study, has suggested a plan which, in our view, solves the problem in a comprehensive and masterly manner. He proposes to charter "The Reserve Association of America"—the capital to be about $300,000,000, the head office to be in Washington, with fifteen branches covering the entire country, divided into fifteen districts. Only national banks can become stockholders—each to the extent of 20 per cent of its capital—and the highest dividend they can ever obtain is 5 per cent; all excess profits, after the establishment of a surplus, ultimately going to the federal government. Time will not permit of a detailed statement of the organization. I believe, however, that, complicated as it may seem, the organization will prove to be simple in practise, and will result in placing the best-qualified men on the board of directors, both of the central association and its branches. The organization also completely protects the association from either political or private financial control. This Reserve Association is to be a bank of banks, its domestic business being confined to transactions with its own shareholders—the banks—and the federal government. How, then, will this institution supply the four chief needs of our financial system which we have described?

ELASTICITY OF CURRENCY

The bonds securing the present currency, amounting to $700,000,000, are to be purchased, and the currency assumed by the Reserve Association. The association may sell not exceeding $50,000,000 of these bonds per year, and gradually retire the bond-secured currency, replacing it with the association's own notes, secured by one-third gold and two-thirds good bank assets, following the German plan before alluded to. All note issues are to be a first lien on the assets of the association. In addition to these $700,000,000, the association may make further issues, subject, however, to a graduated tax. The fifteen branches covering the entire country will supply the necessary redemption facilities. It will be seen that such powers of instantaneous issue and automatic redemption of bank notes supply the element of elasticity so much needed in our country.

MOBILITY OF RESERVES

This is the only great commercial country which, in addition to being blessed with periodical panics, has the happiness to possess a law compelling the banks to keep a certain legal reserve. The law tells us that when our reserves are less than the legal limit we must cease loaning money until they are made good. In other words, we are to keep a reserve, and when the time comes that we need it, we are not to use it. The law reserves in this country have been well illustrated by the story of the hospital bed. It seems that a man left sufficient money to build a hospital, one of the conditions being that a bed must always be kept at the said hospital for an emergency. One day, when the hospital was in full running order, a man was nearly killed in front of the door. They carried him up the hospital steps, but were met by the superintendent with the statement that all of the beds were occupied, and they must take him elsewhere. "But," said the assistant superintendent, "we have the 'emergency bed.'" "Don't you know," responded the superintendent, "that that bed, by the will of the founder of this institution, must always be kept for an emergency, and cannot, therefore, be used?"

The Reserve Association is to pay no interest on deposits, but balances on its books to the credit of other banks, and also its notes on hand, may be counted as part of their legal reserve. Thus a bank which heretofore has carried, say, $100,000 cash reserve will carry only enough for till money—perhaps $25,000—and deposit the remaining $75,000 with the association. This will insure enormous deposits for the association, and the banks will not withdraw in troublous times on the well-known principle that "they do not want the money if they are sure they can get it." Besides, when a bank must withdraw part of its balance, the association can remit the money in its own notes, and without weakening its own reserves. Thus, the reserves of the country will be centralized in one powerful reservoir and used to provide support wherever support is needed. The way our reserves are scattered in this country in time of trouble has been well illustrated by supposing a great city compelling each of its householders to keep on hand one bucket of water for the purpose of putting out a fire, instead of collecting a great volume of water in a reservoir with pipes leading in such a manner as to reach, with the full volume, any part of the city where a fire may break out. At present each little bank in time of trouble has its own little bucket of reserve. The National Reserve Association proposes to provide the reservoir.

LIQUIDITY OF BANK ASSETS

All the privileges and advantages of the association are to be equally available to all banks which have subscribed to its stock, whether large or small, and wherever situated. The association will stand ready and able to rediscount paper of other banks maturing within twenty-eight days at a rate uniform for the entire country. Longer-dated paper may also be rediscounted, but such paper must be guaranteed by the local association of banks. Any solvent bank, therefore, experiencing a sudden withdrawal of its deposits will be able to convert its assets into cash at a fair rate of discount—provided, of course, its assets are good. In addition to this the plan permits the Reserve Association to buy and sell bills of exchange, and allow banks to accept bills of exchange for their customers with not over ninety days to run, to the extent of half the capital and surplus of each accepting bank. Considering our enormous imports, there is now abundant foundation for this kind of business, and thus an international discount market for "prime bills" will be established in this country. This will be infinitely better than forcing surplus funds into demand loans on Wall Street, which is our only quickly available loan market to-day.

CENTRALIZATION OF BANKING POWER CLOSELY ALLIED TO GOVERNMENT

This will be furnished by the Reserve Association, because it is to be the fiscal agent for the Federal Government and the sole depository of Government funds. The Secretary of the Treasury, the Secretary of Commerce and Labor, and the Comptroller of the Currency are to be ex-officio members of the board of directors of the association. In the public mind, therefore, the action of the association will be backed and supported by the Government. This means confidence instead of distrust, financial peace instead of panic.

Now, gentlemen, let me say, in conclusion, that this is not merely a bankers' question. Bankers can worry through panics; and, indeed, the bankers often make more profits at such time than they do at other times, for the simple reason that they get the highest rates the law will allow them for any money they may loan. It is the business man whose credit is curtailed or cut off at such a time, and the long lines of working-men thrown out of employment, who are really the chief sufferers from a panic. Those of you, my hearers, who shipped cattle to Chicago during the summer of 1893, or the fall of 1907, will easily remember the prices you then obtained. This is a question that affects your pockets and the pockets of the entire interdependent business community of the United States.

I know that in some of your minds there is the question as to whether this is not after all a proposition for Wall Street to get control of the money of the country. Believe me when I tell you that there is nothing in this organization for Wall Street to control. J. Pierpont Morgan himself could not have borrowed a dollar from this organization if he had put up Government bonds as security, and the amount that any one bank can borrow from it is so limited that all will be treated on an equal footing.

I know that some of you are prejudiced against the name of Senator Aldrich, and are asking the old question: "Can any good thing come out of Nazareth?" The answer to that question is the same that it was two thousand years ago: "Come and see!"

It is your duty as business men to study this question, at least to the extent of understanding its main features, which I have tried to explain to you. It is your duty to yourself and to your country to co-operate in any way in your power toward the creation of a public sentiment that will say to all parties and to all politicians: "Stand aside with your propositions to get votes, stop your efforts for mere party or personal political advantage, and put the banking system of this country on a par with that of its leading commercial competitors the world over."

If my child is sick with appendicitis, I do not call a shoemaker; I call a surgeon. Most of the politicians of this country do not understand the question. The bankers at last are almost unanimous in its favor. They know, if anybody knows, what is needed to prevent them from having to hang their heads in shame every few years and tell their customers that the banking machinery of this country has broken down, and that their depositors cannot have their money. I beseech you, therefore, bring such pressure to bear in this matter that this reform may be enacted during the coming session of Congress. (Great applause.)

MR. GEORGE H. HOFFMAN, Philadelphia: I move you, Mr. Chairman, that a vote of thanks of this Section be tendered Mr. Forgan for his able address, to which the members have listened with the greatest of interest.

(The motion was duly seconded and carried.)

THE CHAIRMAN: Gentlemen, I am sure that we are all interested in this matter of Publications, which is our next topic, and I will ask Mr. Douglass Burnett, of Baltimore, Chairman, to read his Report..

REPORT OF THE PUBLICATIONS COMMITTEE

The Publications Committee begs to report that it has actively carried on the work assigned to it for the season of 1912-1913, with the result that there have been handled up to the end of March, 165,930 publications, distributed as shown in the table appended. These publications include: "Electric Service in the Home," "Electrical Equipment of the Home," "Industrial Lighting," "Ornamental Street Lighting," the preparation of which was undertaken before the present Committee took charge of the work and the distribution of which was begun in the month of April, 1912, in the case of "Electrical Equipment of the Home," and of June, 1912, in the case of the other three publications. As the issues of these publications have become exhausted, arrangements have been made to meet the continuing demand.

In addition, the Committee has actively proceeded with the program of preparation of new booklets, and has already issued "Home Thoughts Electric" and on April 1 will issue "Store Service," and "Church Lighting." Preparations have been made also for a booklet on "Electricity on the Farm."

The publications of the Commercial Section have also included the original sets of the Digest, and the quarterly issues of it now current, with binders therefor. These, however, required no particular attention on the part of the Committee, as it was deemed more satisfactory that the Committee on Electrical Salesman's Handbook should arrange direct through headquarters for the printing of the Handbook sheets.

In looking over the volume of transactions, it has occurred to the Committee that they may profitably be analyzed in a way different from that shown in the table. A comparatively small number of orders would show either that the larger companies are taking advantage of our publications and the small companies are failing to do so; or, that those companies who are prosecuting active campaigns for new business find the publications successful and are issuing repeat orders. The publications of the Commercial Section appeal particularly to the smaller company members, because the larger companies are more likely to have their own advertising departments, but, on the other hand, these publications should be of such a nature as to be useful to the larger companies also; that is, the publications should be such as to develop new business no matter whether the community served be large or small.

It is desirable, also, that our publications be such that having met with a successful development of the business, re-orders will be issued by the member companies and the field of prospective customers in their territories covered as rapidly as possible. A trial order of publications to be sent to a certain mailing list of prospective customers of any company, whether large or small, should result in a re-issue of other publications by the same company, and a re-ordering of additional copies of the same publication to care for other prospective customers which the company seeks to obtain. Above all, it is desirable that if our publications are of the right nature and cover the more general classes of prospective customers, they should be used by all of the companies making up our Class A membership to interest people in the use of electric service.

Considering these points we find that from August 23, 1912, to April 1, 1913, 128,272 publications out of a total of 165,930 were sent out on 754 orders, an average of 170 per order. The average varies from 1 for binders, 4 for "Ornamental Street Lighting," 14 for "Industrial Lighting" to 85 for "Electrical Equipment of the Home," and 942 for "Electric Service in the Home." That is, for each order that has been sent in the Association has sent out an average of 942 copies of "Electric Service in the Home." The orders are in all quantities, the maximum number of any issue being 10,000.

The total number of companies that have placed these orders with us is 80, and as at the present time there are approximately 1300 Class A members, we find that only 6.1 per cent of our membership have taken advantage of the publications offered for our own use by the Committee, 93.9 per cent of our companies have as yet failed to order any of our publications. This figure of 80 companies excludes the names of those companies ordering less than ten copies of any one publication, and also excludes those purchasing extra sets of the Handbook.

As the publications are of such a nature as to assist in producing residence business, store service, ornamental street lighting business, industrial lighting, church lighting and farm service, it is immediately seen that they cover all the main branches of the business. The Committee particularly urges member companies who have failed to take advantage of the booklets, to place their orders for advertising material, sending them to headquarters, in New York City.

The Committee feels that, as a result of the discussions that have taken place at Executive Committee meetings and elsewhere, the settled policy of the Commercial Section has been determined to be the issuing regularly of publications of the nature of those indicated in this report. The volume of business handled demonstrates that the publication work of the Commercial Section is of real value and interest to the central-station industry, and consequently, that it should be continued. The great demand for the booklets proves that the field is not covered by available publications that can be purchased from publishers or obtained gratis from manufacturers of appliances.

This is a sales-manager's proposition. It is a proposition intimately connected with the new business work of the central stations constituting the membership of our body. The sales managers feel that it is necessary to have a certain class of publications in order to develop new business, and they feel that this should be prepared, as it has been in the current year, by the co-operative effort of commercial men who know the needs of other men in like positions, who are in touch with them fraternally and are willing to undertake the publication work, not for the benefit of their own companies alone, but for the central-station industry as a whole.

The work of the year has been conducted on a publishing basis; that is, we have purchased our publications where we could do so most advantageously, and have sold them at publisher's prices. This program has afforded a source of revenue whereby the Commercial Section work could be continued and without which, under the circumstances, it would not have been done so conveniently. The work has been prosecuted along the following lines: (1) Co-operating with and supervising the work of Headquarters in its carrying of stock, ordering re-issues, sale and delivery of the 165,930 publications referred to above. (2) Constructive, in the sense that it has actually prepared the matter for and has obtained the issue of the several booklets referred to. (3) Commercial, in the sense that one of the Committee, Mr. E. A. Edkins, was appointed as sales-manager to create all the interest possible in the publications of the Committee.

In creating a market for our publications we have used the inside front cover of the N. E. L. A. monthly BULLETIN for our advertisements, and we have issued little dodgers. We have also reported our work, together with the work of other committees, under the head of "News of the Commercial Section" in the *Bulletin,* this portion being in charge of the Chairman of the Publications Committee as Editor.

The Committee feels so very strongly that its work occupies a necessary field that it desires to recommend that it be continued next year, leaving the handling and delivery of the stock with N. E. L. A. Headquarters. And, in order that the best results may be obtained and new life be put into the publications it recommends that, as the work has taken considerable time on the part of the present members and is an opportunity for real service, new members be appointed to the Committee throughout for the following year. It respectfully suggests the propriety of making appointments on the basis of working membership, as the work can be much more successfully and easily done if each member is in position to devote to it the necessary time for his full share.

At a meeting of the Publications Committee, April 25, the following gentlemen were selected to serve on the Committee, in connection with the preparation of the booklet, "Electricity on the Farm": E. P. Edwards, F. H. Gale, J. C. McQuiston, J. C. Parker, C. W. PenDell.

The Committee has been glad of the opportunity to do this work for the Commercial Section, and trusts that it has met with a sufficient degree of success to merit approval and a continuance of the work.

Very truly yours,

Committee
DOUGLASS BURNETT, *Chairman*
P. S. DODD, *Secretary*
J. F. BECKER
E. A. EDKINS
H. K. MOHR
F. B. RAE
W. E. ROBERTSON
M. S. SEELMAN, JR.

SALE OF PUBLICATIONS OF COMMERCIAL SECTION

Month	Binders	DIGEST		Electric Service	Electrical Equipment	Industrial Lighting	Ornamental Street Lighting
		Complete Copies	Additional Quarterly Issues				
1912							
April					2,011		
May					1,016		
June				100	615	100	715
July	14	84		4,776	7,421	8,966	1,096
Aug.	181	215		1,049	8,667	1,338	1,343
Sept.	23	36		28,951	872	337	1,211
Oct.	29	49		17,346	1,507	1,052	53
Nov.	7	15		109	876	32	80
Dec.	34	36		10,124	2,587	4,172	56
1913							
Jan.	43	24	991	28,054	509	177	239
Feb.	63	35	144	16,083	115	353	1,091
March	69	77	1,638	2,132	4,090	591	111
	463	571	2,773	108,724	30,286	17,118	5,995

Total 165,930

This tabulation does not include "Home Thoughts Electric," the "Store Service" booklet, "Church Lighting," or the booklet on "Electricity on the Farm," as these issues were made after April 1, 1913. A statement of transactions after that date should be available at the Chicago Convention in June, 1913.

MR. BURNETT (continuing): I think there is hardly any general understanding on the part of the Class A members of the value of these publications, value that is, in their new business work. To me it is remarkable in many ways that only six per cent of the membership has taken advantage of the publications and that, at the same time, such a considerable number of publications should have been issued to such a small proportion of our membership. If you take advantage of the publications offered through headquarters, samples of which every member can obtain without cost, you will find them suitable for following up new customers and developing campaign work. If only half our members, during the coming year, would see the economy of ordering copies of these publications from headquarters, if only one-half would appreciate the situation and order them, our sales next year would amount to 4,000,000 copies. To me it is remarkable, as I have said, that only 80 companies have taken advantage of these publications, and I confidently expect next year's work to secure orders from 70 to 80 per cent of the members. We are offering these publications at the lowest possible cost, without charge for our services in preparing and editing, and without trouble to member companies.

DISCUSSION

Mr. Jones: I do not think a report such as Mr. Burnett has made should pass unnoticed by the body on the floor. Our conventions are of value only as they produce permanent results. It is very easy for a man to read a report, but here is a concrete example of results. It should appeal to everyone here. Yet 90 per cent do not know what it means. You want to start a campaign and get new business in your residence work. You send out circulars, which you, or your advertising manager, has time to get up and you get out a publication, and pay a good price for it. Now the publication for residence business sold by this Section is about the size of the programme in my hand. It is made up by men expert in their line. It is the thought of all the best commercial managers and it has your own imprint on it. If you are going to start a residence campaign the place to get your material is in your own Commercial Section, gotten out by the best men in the industry. That is what we mean when we say that this work is not appreciated. Less than 10 per cent of the central-station managers have used it. If you really stop to think what the Publications Committee is doing, you will appreciate what a vast amount of work is being accomplished. Take another example. Suppose you are starting a store campaign. There is the Store Service booklet, just off the press, coming to all of you. This is sold at the same price, three cents per booklet with the name of your own company on it. If each central-station manager would appreciate what is in the books, if you would just take the time to get copies of existing bulletins and read them over to-night, I am sure the result will to-morrow be that you will place some orders, and get the best kind of advertising literature.

Mr. F. H. Gale, Schenectady, N. Y.: I do not wish to over emphasize the remarks of the gentlemen who spoke last, but I have been impressed with the same ideas, not only in listening to the report of the chairman, but in some of the work which has come to my attention during the past year. I have found many ideas of the best. It has been my privilege to observe the enormous amount of detail work that the Committee on Publications undertook and has carried through with success, and it is gratifying to know the number of copies of these different booklets ordered. As fast as they were ordered from the printer, they were absorbed by the industry, and I said to myself: "Here is co-operation and co-operative work." I was astounded, feeling that this was a good work and was going on splendidly, to discover that only 80 of the member companies are using the publications, and in thinking the matter over it occurred to me that if this is brought to the attention of the member companies who have not yet availed themselves of these services, we can find out, perhaps, whether or not there is anything wrong with the idea or the way the publications had been sent to them. Possibly they had not received them. It is impossible to feel that the system is a failure when the success it has met with is so great. It seems to me that this report calls for some remarks from those who have not had these booklets, and we should have some suggestions as to how to make this a more complete success next year.

Mr. M. E. Turner, Cleveland: I think Mr. Gale has hit the nail right on the head when he asks whether these booklets lack something, or whether there is something in the manner of distribution which has failed to get them out. It might be pertinent to ask these committeemen to examine themselves inwardly and see if they have used good salesmanship in getting them out. I am of the opinion that the reason why more companies have not purchased these booklets is because they have not yet heard about them. I would like to hear from someone who has not used them. We have not used them in Cleveland and I would like to hear from others. We did not know the value of these different publications.

Mr. M. S. Seelman, Jr., Brooklyn, N. Y.: It may have some bearing on the statement made by Mr. Gale and the commentary by Mr. Turner, that it has been only within the last few weeks that some of the most important of these booklets have been issued. The Store Service booklet has not been distributed at all as yet, because it is only within the last week that it has come from the press. I believe it to be one of the most valuable of the publications which the Section has issued, and it should have a large sale. There is the booklet on Church Lighting, also a very recent issue. The publication on Electricity on the Farm has not yet been generally issued; so you will see that opportunities still remain for those companies who have not had the publications issued by the Committee, to get these booklets and become familiar with them. As a member of that committee I ask every central-station manager and commercial manager and sales manager to give serious consideration to these various booklets which have meant so much work to the Committee, and utilize them, as they can be well utilized, in increasing and developing business.

MR. S. G. MCMEEN, Columbus, O.: We all know that it is a year or two in most cases before the books issued by publishing houses have a wide circulation. Many of them fail. Those that succeed, however, require time to get started and to arouse interest. I think we should feel very optimistic to-day in this Section, on the report of the Publications Committee. During the year it has issued certain publications which are known by at least a few of our central stations. I believe that after this Convention you shall have a large support throughout the country and many requests for copies of these booklets to spread and extend the business of the central stations.

THE CHAIRMAN: This matter of publishing booklets on the different phases of our business in somewhat new, and, therefore, before going deeper into it, it is necessary that we get full discussion in order that we know we are on the right track. I think we ought to hear from some of our friends, the advertising, men, who are not entirely central-station men. We are not afraid of frank remarks, and I am going to ask Mr. Lee to talk to us on this subject.

MR. C. W. LEE, New York City: Frankly, I have not given this matter any particular study. Our organization is not in the publication business at this time; we passed that up a good many years ago. One of the speakers hit the point when he stated that it is a question of salesmanship. Now, it does require a little good selling work to get a publication before the industry after you have it out; in other words, it is necessary to instill the thought in central-station men along constructive advertising lines. These booklets represent only one thought in any particular line of salesmanship or constructive organizing plans, making it a part of the plans of the commercial department. I have only looked at these publications casually, and have used a few in some campaigns we have been conducting. I think they are very good and the committee has been working along the right line. But the advertising man, especially the sales manager, must be governed by the thought that one booklet will not get the business; it must be followed up. I believe that the advertising matter the committee has sent out will bring better returns during the next year when the industry knows more about the objects of the committee.

Mr. C. P. Osborne, Spokane: I, too, believe that it is a matter of salesmanship, and that you should get this literature to the right people in the central stations, those who will take an interest in it. If these booklets are sent to the general manager they will be thrown into the waste basket. We have not the time to look at them, but proper salesmanship consists in getting at the right people. You are selling this booklet, so be sure that it gets to the right man.

Mr. D. H. Miller, Chicago: I would like to ask whether, under present arrangements, these publications are issued and sent automatically to every member of the Commercial Section? I have seen only a few of them myself.

The Chairman: That is what each member will receive.

Mr. Miller: I sent for and bought several of the publications of this Committee, notably the one on the wiring of homes. I might say that I had intended to purchase several hundred, but after reading it over, I concluded that I did not want it. It seemed to me to be overdrawn. There were outlets and drops suggested for every room, three or four in a room, and if I should send the book to my customers they might think that it was an enormous matter and turn it down. The editors also put in the idea of an "expert," "our expert will call on you." There is too much of that in the booklet.

Mr. J. C. Parker, Rochester: The reason why some of these booklets have not taken hold is, I suppose, due to lingering suspicion, similar to what I had when I first ran up against some of these examples of "canned" literature. I do not myself believe in canning literature, or that any canned literature can be as effective as what a company can get out for itself if it has a good man. I do not think that Brooklyn can write for Rochester, or Rochester write for Brooklyn.

MR. SEELMAN: I am not ready to admit that on the part of Brooklyn.

MR. PARKER: I believe that this is the case with us. I think that our local literature must be better for our own community, and many of the advertising men, who are not altogether free from egotism, think that, because these booklets are "canned" they are not good; but they are far from being bad. In looking over "Home Thoughts Electric" I find one thing that seems to me to be subject to criticism, but there are 99 things in it so good that it is captious to object to the one. If we have 99 grains of wheat in a booklet we need not worry about the one bit of chaff. We must not let circularization go by because we have not the time to put out our own, or to write something better than the stuff already prepared. Most circularization must be done by reiteration—by taking the subject from different angles—and if these booklets have some good in them they are certainly worth while. They are good things with which to supplement our own publications or to put out ahead of them. One thousand booklets, at three cents each, would cost only $30, and it is a pretty small shot to take in an advertising campaign which would bring in $60 a year gross revenue, and any publication which will not bring in $60 a year is a pretty poor publication. The game is certainly worth the candle, either to supplement or precede our own local campaigns. I am suggesting this, because it seems to me that the criticism of "canned literature," which I have proposed I have fallen heir to from our friend McSweeney, and it may be that some of the other members have had it, and have been kept from ordering as extensively as they should.

MR. SEELMAN: I notice a note of apology in some of the statements made by the speakers in regard to the work of this Publication Committee. I want to say that I don't believe there is a member of this committee who believes that there is the thousandth part of an apology due or that the Section at large has, or should have, anything but praise for the amount and quality of the work done by the Committee. This work is the best of its kind that was ever gotten out by any organization, private or public, along commercial lines or advertising lines. These publications are good, and they are good for general use. I do not mean to imply that they are going to meet every condition in every central station, but they meet the average condition, and can be utilized much more than they are now. I do not mean to say that the central station that purchases this Home Thoughts Electric, for instance, should finish its campaign with that publication, but they have in that publication a splendid unit to use. After we have used that there is nothing to prevent us, two weeks later, from getting out a local effort, telling how John Jones' house, or William Henry's house has been wired, putting in a picture and stating the results achieved. Send that around and follow it up from week to week, or month to month, according to the money you have or as your activities will permit. But these units are splendid units and the best that can be gotten out along that line, and they can be utilized to splendid advantage.

Mr. S. M. Kennedy, Los Angeles: I do not wish to criticize at all, but you have asked for some suggestions and Mr. Seelman has perhaps misunderstood some of the earlier remarks. In looking over this particular booklet, and also in reference to some others which I have seen before, I have one suggestion to make which, I think, would be applicable to most companies. My company, I know, and I think the larger companies, have found it to great advantage to write their own advertising as they think best. Usually when we write our advertising we send it out on one subject at a time, and possibly it might be well to subdivide the subject and put the booklets out at separate times. This booklet, for instance, "Why Electric Service Benefits the Store and How to Use It," is one of the best of its type I have ever seen. But these are busy times, and the average customer has not the time to sit down and read it through. Your prospective customer will possibly run through the book to look at the pictures and then push it to one side. The way that my company could use literature of this kind would be to have it subdivided and sent out in sections. Here is a splendid article, six or eight pages, to start out with on store lighting, and what it says is to the point. There is not one word that is unnecessary. At the same time, it is not a booklet such as we could use with all these other headings, and, as I say, the average customer will not take the time to read it through if it is all given him at once. Consequently, my suggestion in connection with publications of this sort is that if these topics are compiled in one booklet they should be subdivided, and it should be possible to obtain the divisions.

MR. BURNETT: We shall be very glad to fill your orders at any time on that basis.

MR. KENNEDY: Then that simplifies the matter, and it seems to me that if the member companies know that they can obtain these booklets in sections it will be a great opportunity.

A MEMBER: I just want to say a word as manager of a small station. Our manufacturing friends have been so generous with their literature that up to the present time I have not found it necessary to use anything of this character, but it seems to me the work of the Committee and its publications are mighty good stuff to put before the public, and I for one, propose to use some of them.

MR. M. V. STAGG, Fort Wayne: I move that the Chairman appoint a committee to nominate officers for the coming year.

A MEMBER: I second the motion.

(The motion was put and carried.)

THE CHAIRMAN: The next paper on the program is one in which I have personally had a good deal of interest. I feel that the matter of delivering to our salesmen matter which they can use in their everyday work is of the utmost importance. I, therefore, take pleasure in calling on Mr. E. L. Callahan to read the Report of the Committee on the Electrical Salesman's Handbook.

REPORT OF COMMITTEE ON THE ELECTRICAL SALESMAN'S HANDBOOK

The commercial managers and salesmen of public utilities must have reliable information upon the various subjects demanding daily attention. Until recently commercial men were forced to the choice of three methods:

(a) Reference to voluminous files and libraries on technical data

(b) Condensed card files, vest pocket notebooks or loose-leaf data jotted down from time to time

(c) Depending upon memory alone.

The Committee is endeavoring to place in the hands of commercial men complete and dependable information which will assist them effectively in closing valuable business.

PURPOSE OF THE HANDBOOK

A Committee was appointed to formulate methods which would assist men striving to accumulate in a systematic way useful and necessary knowledge and data. The task has been difficult, but although the Committee has only fairly started the work, it has collected a considerable quantity of reliable, accurate and practical data upon a large number of electric power and lighting installations. With the assistance of member companies it will be possible in the course of a few years to make the Electrical Salesman's Handbook very complete. To do this it is essential that additional data on special subjects be obtained, by closely following the advancements made in commercial methods and the newer applications of electricity for power, lighting and heating.

ASSISTANCE OF REPORTERS

In view of the large amount of labor and expense involved in obtaining the data, the Committee wishes especially to thank its reporters, who are busy men in the utility business of the country, for their co-operation in obtaining statistics on power installations, for incorporation in the issue of loose-leaf data sheets which comprise the principal part of the Committee's work during the year just closed.

The Committee also wishes to thank heartily those who, although not regularly appointed reporters, assisted in the work, not only in securing data, but also in abstracting articles which had been published in technical and trade journals, proceedings and special literary productions; these abstracts appearing on the pink sheets as part of the Handbook. Among these, the Committee would mention the Westinghouse Electric & Manufacturing Co., the General Electric Co., *Electrical Review and Western Electrician,* and *Electrical Merchandise.*

SUMMARY OF THE YEAR'S WORK

The report is intended to be brief and will simply summarize the contents of the four issues of data sheets sent to all commercial section members in good standing as of June 1, 1913.

This year's work of the Committee under the name of the "Committee on Electrical Salesman's Handbook" is a continuation of that of last year, and by the same committee members, except that Mr. C. J. Russell has served in place of Mr. E. W. Lloyd. The title, "Electrical Salesman's Handbook," was thought to be a more suitable name for the collection of data than "Commercial Section Digest."

Starting with the "Commercial Section Digest," as presented at the Convention in June, 1912, with data on power on 230 installations, there have been added and sent out the following data in loose-leaf form:

September, 1912, data on 119 power installations (a few of which were revised data sheets);

December, 1912, data on 56 power installations;

March, 1913, data on 53 power installations;

June, 1913, data on 110 power installations.

Total data from June, 1912, to June, 1913, 338 installations.

December, 1912, number of abstracts............. 16
March, 1913, " " " 15
June, " " " " 33

Total abstracts, year ending June, 1913........... 64
Total power data and abstracts from June, 1912, to June, 1913 402
Grand total of power data and abstracts from June, 1911, to June, 1913.........................681

Subjects Covered

All of the data and abstracts have been taken from installations using central-station service. There are about 175 different classes of business covered by power data and abstracts. The data given was taken from the practical operation of plants under the prevailing conditions, and in no case under test conditions.

The giving of load-factor figures was discontinued temporarily, beginning with the September, 1912, quarterly issue of sheets, for the reason that the connected load-factor is not generally used by member companies, and it has been almost impossible as yet for the Committee to obtain the kilowatt demand figures of installations reported.

The Committee realizes that the Handbook contains principally data on power installations and that commercial men are desirous of obtaining data similar to that given on power, from lighting installations. The Committee decided, however, that it was better to devote the second year of the work to the getting together of fairly complete and comprehensive data on power, leaving data on lighting to the Committee to be appointed for next year, it not being practicable to give the necessary attention to both lighting and power this year.

Recommendations

The Committee recommends as follows:

1 That the Electrical Salesman's Handbook be continued and the work carried on for another year by a committee composed of new members.

2 That the principal work of the Committee to be appointed for another year be to secure data on pure lighting and mixed power and lighting installations, covering as broad a field as possible, also that power data similar to that heretofore compiled be secured on the subjects mentioned below.

3 That one person, a member of the Committee, preferably located at Association headquarters, be responsible for the systematic perusal of the technical and trade press, magazines, papers, journals and proceedings of societies, etc.

4 That the Electrical Solicitor's Handbook be revised and merged into the Electrical Salesman's Handbook. The Solicitor's Handbook was turned over to the Electrical Salesman's Hand-

book Committee during the latter part of 1912, but it was not thought advisable by the executive committee of the section to add it to the Salesman's Handbook or to revise it during the year just closed.

Particular attention is called to the need of practical and working data on the following subjects:

Boat and shipbuilding
Boiler works
Broom factories
Cement mills
Cotton mills (including cotton gins and cotton-seed oil mills)
Electrochemical plants
Electrolytic plants
Electrothermal plants
Fertilizer plants
Glass factories
Knitting mills
Heating devices—large
Lighting—commercial
Lime kilns
Logging
Mining—various kinds
Paint works
Pulp and paper mills
Pipe factories
Pottery factories
Pumping
Railroads—shops, signals, etc.
Sand and gravel
Vehicles—electric
Woodworking (including processes of offal disposal)
Woolen mills

CONCLUSION

The Electrical Salesman's Handbook presents itself to you in the form of two loose-leaf volumes with sheets the size of the Association Bulletin and convenient for daily use when properly contained in special leather binders, which are for sale at Association headquarters, at a price of 75 cents each.

A free discussion on the floor at this Convention is welcomed in order that suggestions and comments may be recorded.

Respectfully submitted,

Committee
E. L. Callahan, *Chairman*
T. I. Jones
C. J. Russell
G. Burkhalter

Mr. Gale: I think few of the members of the Commercial Section have had an opportunity to personally observe the work of the Committee, and they are not aware of or do not realize the amount of labor that this Handbook involves. The results are such as could not have been accomplished for many times the commercial dues of the entire Section. There is not an organization in the country, outside of this Section, that could have undertaken the work of preparing and distributing a book of this kind which would be at all comparable in value to the industry. The Committee deserves great credit and I move a vote of thanks on behalf of the Section for this excellent work. It has been the backbone of the Commercial Section and the present Committee is responsible for it.

(The motion was seconded and carried.)

Mr. Norman Macbeth, New York City: I do not mean to be ungracious in raising the question. After looking over the handbook, I can say that it is very properly, as Mr. Gale says, a book which could not have been put out otherwise for many times the money spent on it, but it seems to me that some attention should be given not only in the Report but, from time to time, also in the publication of the quarterly issues, to the lighting side of the question. We feel that the lighting end of the game is our bread and butter and the companies should realize that by going after the lighting the same as after power, they can increase consumption many times. I would like to suggest that sheets on lighting be added, designated in contra-distinction to sheets on power, say, in the matter of color. Then, when salesmen go to a machine shop or to a laundry they will have all the necessary data for both lighting and power.

Mr. Callahan: The committee, during the next two years, should give particular attention to the securing of data on lighting installations. It was impossible to properly take care of the investigation of purely lighting installations this year, due to the labor involved in securing data on power. We have already sent out considerable data on general lighting—factory lighting and store lighting—in combination with power installations. There is also considerable unfinished work on power installations which should be completed next year, but, at the same time, the attention of the Committee should and can be principally devoted to lighting.

Mr. Osborne: I would like very much to see the maximum demand inserted in these reports. Otherwise those of us who base our rates on maximum demand are at a loss to know how to figure a bill. I have noticed in placing this book in the hands of a prospective customer, that he was very much interested in the data given.

THE CHAIRMAN: The maximum demand should be given on power data sheets, but it is very difficult to secure this data from the fact that there are not very many companies using maximum demand measuring instruments, excepting in large installations. The connected motor load is given, but the actual measured kilowatt demand is not always known. The Committee is trying to obtain this information and you will find it on many of the sheets.

MR. JONES: Supplementing Mr. Lloyd, I would like to say a word on the subject of demand. It is well known that the demand may be a certain amount for an interval of five minutes, less for ten, and still less for thirty; so that the mere statement of maximum demand as a certain number of kilowatts does not mean anything at all unless you also state the period of time over which the demand runs. The Committee has furnished data, giving a specific demand over stated periods of time.

I want to say again that you should realize just what these sheets mean to you. In Brooklyn we have closed a contract with a large paper mill with a guarantee of $45,000 a year. Suppose that a paper mill is projected in your territory. They have a pretty constant method of operation. Data which will apply on one mill will, as a rule, apply on another, even in a different part of the country, and you can, by consulting this book, put the facts before your prospect. All of the data which is in this handbook is verified and checked. It is checked by men who *know*, and when it is received at headquarters, it is again checked up and verified. There is no guess work in it.

(Adjourned.)

SECOND COMMERCIAL SESSION

Wednesday, June 5

The Chairman, Mr. H. H. Scott: The first number on the program this morning is the Report of the Committee on the Education of Salesmen. Mr. George Williams, of New York, Chairman, has not yet reached the city, and this Report will be presented by Mr. Fred. R. Jenkins, one of the Committee.

REPORT OF THE COMMITTEE ON EDUCATION OF SALESMEN

Your Committee has carried on investigations and gathered the information contained in this report which concerns principally the education of salesmen for central station companies. The Committee considers the central-station salesman to be indirectly the means of disposing of manufacturers' products, including electrical machinery, appliances and supplies, as well as the energy of the central station by which he is employed. The present day central-station manager fully appreciates the advantage of having systematically trained salesmen and has satisfied himself that with the increased uses for his product this education has practically become a necessity for the proper marketing of it.

The installation of large centrally located turbo and hydro-turbo generating stations, together with high-tension transmission coupled with local substation distribution, has opened up fields for the use of energy which a few years ago were not considered profitable. This immense field of new business requires men having an all-around general training, capable of taking care of a district and meeting intelligently any local conditions without recourse to the home office.

Central-station managers all have their ideas as to the proper qualifications for a salesman; and not as information but more as a reminder, the following general characteristics are named:

(1) Thorough knowledge of a customer's problems and how to solve them
(2) Good health
(3) Enthusiasm
(4) Courage with modesty
(5) Imagination
(6) Strict regard for the truth, with a reputation for frank honest dealing
(7) Sales temperament
(8) Ingenuity
(9) Good manners
(10) Strict regard for personal appearance

(11) Unfailing good humor, affability, pleasing address, ability to adapt one's self to circumstances, with an intuitive consciousness where perseverance ceases to be a virtue and becomes a nuisance.

In its investigation your Committee, through the best available sources, obtained a large amount of information much of which was too general for this Report. However, a great deal of it is considered of too great value to be disregarded and certain features have been selected, which, while not new, will stand repetition.

"The average central-station employee who has not had experience in the selling part of the business, sometimes has the impression when he reads that 'John Jones has been pursuaded to throw out his isolated plant and install central-station service' that Jones' contract was obtained much in the same manner as a book agent might get an order."

"Many salesmen lose sight of the fact that they are absolutely in the right in presenting their proposition to a customer. This fact is driven home in the training of the salesmen for one large corporation by the statement that the company has upwards of 200,000 customers, and it is impossible to conceive that this number of people are mistaken in selecting central-station energy for their business. This fact is carefully brought out, and when the salesman approaches a prospective customer in ninety-nine cases out of a hundred he secures the business, because he believes he has something which it is right for this customer to use; that it is to the advantage of the customer to have his service. This, when thoroughly appreciated, begets confidence in the salesman, who appreciates that he is not to be classified as a man that can sell the customer something which he does not want. In approaching his prospective customer he knows that he is offering something which this customer is in need of, thereby his duties are cut in half, as he simply has to show the customer the advantages, and a large part of the selling will take care of itself."

"It is the opinion of many large companies that particular sections of the community covered require salesmen of distinctive character, as the type of people and character of service differ so essentially."

"It is the opinion of some that 'salesmen are born not made,' although the qualifications inherent in a man can be brought out and broadened."

"Probably all of us are aware that even the best educated men are oftentimes absolute failures as salesmen, not being possessed of the sales temperament."

"The first qualifications of a successful salesman are: an effective personality, good humor being a predominant characteristic, and the absence of a continual grouch; imagination also, to a degree, is a desirable qualification, although not to the extent of dreaming, which often leads to statements detrimental to the company; absolute honesty in statement to customers whether for or against the company."

"The salesman must be loyal to the organization he works for, must listen to no detractions of it nor have even a suspicion in his own mind. Otherwise he should not work for the company, as a man who has not self-respect enough to leave a position when he has lost his interest in it, is not fit to have around."

"Salesmen should not be purely technical, as a salesman who talks technicalities to a layman generally gets nowhere."

"Aside from good health, already mentioned, neatness in dress and cleanliness of person even to the smaller details, are worth while.

"All of us are aware of the advantage of giving attention to these small details, but it will be noticed that while many salesmen appreciate the benefits, they fail through carelessness or otherwise, to make the necessary effort."

Many of the larger central-station companies have established their own schools for the training of the men selected for employment in the contract and other commercial departments. These methods will be described later on in the Report.

This method is, of course, impractical and too expensive to be adopted by the majority of the smaller central-station companies who are members of this Association, but many of these are obtaining good results through the organization of New-Business Departments and the training of salesmen directly under the Local Manager. This Manager has usually graduated as a district salesman. Under his supervision morning meetings are held, which are made the medium of every important feature of sales work, covering the plan of campaign, harmony of purpose, special instruction and specific suggestions for closing contracts. The Manager here has an opportunity to correct erroneous methods, to introduce special campaigns, to encourage his men and to keep his finger on the public pulse.

It has been found that the department which meets every morning has a higher standard for the men than the department which does not. The beginner sees a few prospects for business only, but association with his fellows soon multiplies his visible opportunities. A salesman can hardly fail to start his days' work aroused and reliant after he has met his fellows in session, and the results of these morning meetings have been highly satisfactory.

Once a week such a department should hold an evening meeting, which might be attended with advantage by the heads of other departments and the executive officers of the corporation, many of whom are now taking a keen interest in new-business work and are vitally concerned in the New-Business Department.

As to the results obtained through this system, we quote an example as follows:

"Answering your inquiries regarding lost opportunities, and increasing efficiency by systematic training and instructive application we wish to advise that this company recently acquired a property where the sales and advertising expenses were approximately 5 per cent of the gross receipts, and during the first six months of our control, we released 17 men in the sales organization (some were replaced, others were not) and increased the power business contracted for by about 100 per cent over the best previous record for the same number of months. We gained in meters to an extent that would about equal 35 per cent in one year of the total number of meters gained during the previous operation of the company, and at the same time reduced the cost to about 2½ per cent of the gross receipts, or around 50 per cent of the previous expenses. This improvement can be traced entirely to the training and constant supervision given to the solicitors. Proper men were selected for the various branches of the work, and from three-quarters of an hour to one hour each morning devoted to improving their ability and increasing their knowledge; this during the first two months. While reorganization was being effected, many night meetings were held to hasten developments. If for any reason we are obliged to suspend the training of a salesman, there is a noticeable decrease in returns, and we believe the best results can be obtained only by continually providing more advanced methods for increasing their individual efficiency."

One of the most difficult features in corporation schools for the training of salesmen is the selection of the men for such training. The larger colleges having a course in electrical engineering are yearly more and more recognizing the opportunities afforded for their graduates on the commercial side of our industry, and men so equipped, who have a natural adaptability for commercial work, are considered good material. On the other hand, many technical men, being too academic in their habits and environment, utterly fail in the commercial line. Again, it is found that some of the most successful salesmen have been those who have not had the advantage of college training, but who possess salesmanship ambition and strive to overcome the handicap of lack of technical education, and by helping these men we are developing material that we are badly in need of.

In a recent address, a prominent business man drew up the following trial balance of the positive and negative traits of character of the average college graduate:

Negative Traits

Impatience to succeed
Lacking in experience
Inclined to snobbishness
Lacking in industry
Lacking in thrift
Lacking in technical training (has more than old college type)
Lacking in appreciation of time
Easily discouraged.

Positive Traits

Has more concentration
Knows where and how to look for information
Reasons from one step to another
Is more adaptable
Is more conscientious
Has a keener appreciation of the duties of life and its responsibilities
Is able to solve more difficult problems
Has higher ethical and moral status
Has larger view of life.

These deductions may have been derived from a chance selection of college men, possibly not suited for the work selected, or from an entire class, which brings out the well-known point that "it is the man himself rather than the training." It is said that "If a man is a fool when he goes to college, he comes out a bigger fool;" "if he is a good man when he enters, he comes out a better man."

Many college men get false ideas of the positions they should occupy upon graduation, and until they have been in business for a period of months or years, they do not appreciate the fact that their college training was really only preliminary.

SELECTION OF INSTRUCTORS AND INSTRUCTION

In the smaller companies, where it would not be profitable to operate a department for the instruction of salesmen, the instructors would necessarily be the Sales Manager and his assistants. In the large companies, where the demand requires a special department for this work, a special instructor to give his entire time to the school is engaged. The instructor should have had some previous training along this line; should be a technical graduate, and if possible one who has had considerable shop experience. Aside from all this, he should be taken from the organization of the company.

In all cases the school should be able to call upon the best men in the company in their line of work for lectures covering the commercial application of apparatus which they have made a specialty of handling. It is also advisable that the class hear frequent talks from men in the engineering and operating, accounting and executive departments, as general all-around knowledge is as essential as particular knowledge of the product sold.

SCHOOLS

It has been found that all of the large manufacturing companies are willing to allow their local representative to talk to classes on the special applications of their apparatus.

Your Committee considers of value a short description of some of the larger schools now being operated by the various manufacturing and central-station companies.

CHICAGO CENTRAL-STATION INSTITUTE

This Institute was organized for the purpose of training men for the Contract and Sales Divisions of the following companies: Commonwealth Edison Co., Public Service Co. of Northern Illinois, Middle West Utilities Co., Illinois Northern Utilities Co., and Federal Sign System Electric.

During the entire course the Institute has charge of the men, as it does not consider it to the best interest of the student to give part of his time only to the work, and practical experience in the different departments is considered as important to him as work in the class-room. The underlying idea of this school is to obtain the best possible minds, capable of being trained to fill the higher positions in these companies later on.

While a four-year course in electrical engineering is of great advantage to a man, the school does not require this foundation. Providing the applicant has a good general education together with some foundation in the fundamentals of electricity and is commercially inclined, he is considered favorably and given an opportunity to pass the entrance examinations.

At present this school has students enrolled whose qualifications vary from a four-year engineering course to a technical high school education, with some practical experience.

The course given covers a period of eleven months, subdivided in such a manner that each month is devoted to one branch of the business. This is to enable a student to enter the first day of any month and be graduated eleven months or a year from that time. Inasmuch as the demand for trained men is continuous throughout the year, this method was adopted to enable the school to deliver graduates over several periods during the year. The hours filled with school work are from 8:30 a. m. to 5:30 p. m., with the exception of Saturday, when the closing hour is 1:00 o'clock. Class instruction under a special instructor consumes the forenoon from 9:00 until 12:00 o'clock. At 1:00 o'clock the students report at the departments to which they are assigned, where they work until 5:30, under the guidance of the men in these various departments connected with the commercial side of the industry.

The forenoon class-room instruction consists of problems, examinations, demonstrations and general instruction; frequent lectures are also given on the subject under discussion by specialists in their lines of work from the different companies interested. In addition, lecturers are obtained from the manufacturing companies, dealing particularly with the commercial application of the apparatus, its general construction, purchase price and cost of operating.

It is the intention to give these men a general, all-around education covering every phase of central-station practise, to enable them to handle intelligently any of the general problems brought up to the solicitor of to-day, without recourse to the office for information and advice. Upon graduation these men should be capable of taking charge of a section or district, to thoroughly and completely handle the commercial problems involved.

The subject of salesmanship is inter-woven throughout the entire course; together with this, the subjects covered are: generating stations and distributing systems, electrical construction and inspection, metering, accounting—including mercantile accounts, sales organization, electricity in residences, theaters and churches, illuminants—which includes all makes and types of lamps, store lighting, electric signs, factory lighting, rates and rate-making—including characteristics of service and rate adjustment, motors and motor installations, isolated plants; also miscellaneous industries, including electric vehicles, delivery systems and battery charging, mechanical refrigeration, compression and absorption systems, mining, electric furnaces, water supply and drainage, farming, and street and interurban equipment requirements. For each of these industries a study is made of the operating conditions, the electrical requirements and the cost of purchasing current. Each of the subjects named is subdivided into about 20 sub-heads.

The institute does not guarantee positions to the graduates, but the increasing demand for high-grade trained men practically assures to all those who have thoroughly carried out their part of the contract, and proved themselves equipped by natural inclination for this work, an opportunity to show their ability in one of the companies interested.

GENERAL ELECTRIC COMPANY

The work of training commercial students is made as general as possible, with a view to turning out men who will require the least amount of general direction and supervision, after they have had some experience in the department to which they are ultimately assigned.

Selection

The selection is made from technical graduates who have had experience for one year in a testing department, and who have pronounced commercial adaptability. The selection of instructors, who are specialists in the subjects they are invited to discuss, is from the Commercial, Engineering and Production Departments.

Program

The program includes a commercial study of the details of construction of the company's product and the interrelation of the several subdivisions of the company's Commercial Department. Considerable time is devoted to the study of the problems of salesmen, questions having a practical application. The work includes a study of the fundamentals of successful sales work, together with the distinctive features of the company's product. Class-room discussions and trips through the factories in conjunction with lectures and the "problem method" are used. A portion of the work reproduces actual commercial transactions. The time required is from four to eight months, and when students have completed the training, they are assigned to the commercial offices.

Results

Thus far the results indicate that the system of training should be continued.

NATIONAL QUALITY LAMP DIVISION OF THE GENERAL ELECTRIC CO.

The Engineering Department of the National Electric Lamp Association has no prescribed course to be followed in the education of technical men for commercial positions. Men are chosen for work in the Engineering Department by selecting from a list of applicants those who seem to be best fitted for its various manufacturing and commercial activities. After selection, the men enter the Engineering Department in any one of several different sections.

It is our policy to study continuously each individual man to find out what class of work he is best suited for. This is done by talking with him of his likes and dislikes and by a careful scrutiny of the work which he is doing along various lines; from his weak and strong characteristics determining where in the organization he would fit to the best advantage.

Men with promise of development along commercial lines are given actual work which will allow them to become familiar with incandescent lamps, their method of manufacture, etc. They are also given work along the line of technical publicity, economics, commercial engineering and illuminating engineering, all of which lines are more or less closely allied to the commercial part of the business. There is no prescribed time during which a man must remain in a section. The time spent in any line of work will depend on the individual and the special requirements in each case. The men leaving the departments usually accept positions in the commercial end of the business, either as salesmen or sales engineers.

It has been stated that the Engineering Department does not maintain a course for the instruction of salesmen. It will be seen, however, that work in the Engineering Department is of such a nature that some of the men automatically obtain training for saleswork. That such men are valuable to the organization is proved by the fact that we are having repeated demands for technical men to fill positions in the sales organization.

THE NEW YORK EDISON CO.

"The work of training employees of the Commercial or Contract and Inspection Department is made general with a view to increasing the personal efficiency of each and of rendering better service to the public on the part of our company.

Selection of Employees

"We have devoted our energies to educating the employees who constituted the department at the time the commercial or sales educational courses were instituted about two years ago. We take the employees who are engaged for this department by the General Inspector and no effort is made to eliminate or select on the basis of sales temperament. This process of elimination is recommended, however, wherever practicable.

Selection of Instructors

"Our 'instructor-in-charge' is a college graduate with experience as an instructor in college, a thorough electrician who has taught in electrical schools and has done practical work. The secretary of our school, who also aids in instruction work, is a college graduate and has peculiar ability which fits her for the duties she performs.

Methods

"Our aim is to increase efficiency generally and not merely along specific lines. All lectures and classes are held in company time. Enrollment and attendance are compulsory. School sessions are held at 4 p. m. and are one hour and a half in duration. There is a written examination on each lecture. Each examination is rated by the instructor in charge and students must pass the first year courses with a rating of 75 per cent or better before they can be enrolled in the second year courses. All enrolled students are performing regular duties in the company. No student does more than one hour and a half school work per week. Students with a rating of 75 per cent or better are graduated from the second year courses and receive certificates graded A, B and C, according to their ratings.

"Trips through the generating and substations, the meter department and other operating parts of the company are taken with a view to familiarizing employees with the ability of the company to furnish high grade and continuous service. The period of study covers two years; about six and one-half months schooling each year.

Courses

"In the first year courses there are 56 lectures and 28 examinations; in the second year courses, an equal number. All lectures in the first year are given by the manager and instructor in charge. The first year term is divided into four parts:

(a) Elements of Central-Station Business Getting

"These lectures are based on the National Solicitor's Handbook, citing the book for reference.

(b) History and Development of Electricity

"Lectures in this course are prepared in the narrative style and given as a continuous story of the origin of the electrical industry and its development.

(c) Basic Principles of Individual Efficiency

"The lectures in this course are intended to be inspirational and to aid in self-development.

(d) Public Speaking and Business Letter Writing

"In the second year term there are three parts:

(a) Hygiene, Health, Recreation and Elements of Psychology

"Lectures in this course are given by most eminent authorities on health subjects and psychology.

(b) Basic Principles of Salesmanship and their Relation to Business Building

"Lectures in this course are given by the ablest authorities on sales subjects that can be obtained.

(c) Policies and Organization of The New York Edison Co.

"Twenty-six lectures cover fully and completely the various departments of the company, how they work in harmony with other departments, the policies of the company, etc.

"We aim to have every employee of the department so thoroughly familiar with its workings as to be able to answer intelligently and fully any question which the public may be expected to ask.

Results

"A lessened number of complaints on the part of the public; increased volume of business; a higher operating efficiency. The executives of the company have accepted our commercial school as something that is desirable and valuable and have adopted its work as a part of the general public policy of the company."

WESTINGHOUSE ELECTRIC AND MANUFACTURING CO.

"As soon as it has been decided that the student graduate has the characteristics necessary in commercial work, his record sheet is given to the Sales Department representative of the Education Committee, who, from this date supervises the training and instruction of these prospective salesmen. Since the company has the advantage of choosing from quite a large number of men, it usually gets very good material for commercial work, consequently the percentage of those who make good out of the men chosen for sales work is very high. This segregation usually takes place some time during the first eight months on the Student Graduate Course.

"In the shop the men become familiar with the construction and assembly of apparatus of all kinds as well as the various test methods used to determine its performance. In the Production Department they study the determination of costs, methods of efficient production and the general relation of the Sales Department, Engineering Department, Storekeeper, Manufacturing Department, Inspection and Shipping Departments. In the Sales Department they become familiar with the commercial application of the apparatus, as well as the general methods of handling inquiries, quotations and orders.

"While in the Sales School these salesmen take up methods of merchandising, the science of business building, business economics in general, the sales manual of the company, the electrical Solicitor's Handbook and the writing of sales talks on various types of apparatus. By means of actual sales demonstrations in front of the class, the student is permitted to try himself out under fire, so to speak.

"This training is carried on by requiring the students to spend the major part of their time on active productive work, having from 1 to 5 hours' class work per week in the Educational Department on company time. The training schedule also requires from 14 to 21 hours per week of outside study. The outside study is utilized in becoming familiar with the company publications furnished to each man, thus permitting the time in the class-room to be devoted to commercial discussions and conferences, under the leadership of specialists on the various lines taken up. Examinations are given at regular intervals to see that the men utilize their study time outside of working hours to the greatest advantage.

"The time devoted to shop and test work in the factory ranges from 8 to 12 months. Each salesman then spends approximately 3 months in the Production Department, 4 months in the Sales Department and 2 months in the Sales School, in the order named.

"Upon leaving the Sales School each salesman is transferred to the District Office to which he seems best adapted, for a 3 months' trial. At the end of these 3 months he is taken on regularly if he has made good; if not, he is either transferred back to the factory or released.

"The number of men who take this training course varies on the average from 60 to 70 men per year. It is determined, of course, by the demands from the various District Offices. We have found that the expense involved in connection with the training of these men is a very small item in comparison with the increased efficiency in active District Office work.

"Upon completion of this training, it is, of course, highly important that the men should continue the regular weekly meetings of the departments in which they are engaged, and it is advisable where possible that the graduates from these schools attend any special lectures bearing on new or advanced ideas being brought out from time to time.

"This Committee recommends for text-books for study classes, the Solicitor's Handbook and the current reports of the Commercial Section of the Association. It also submits the following list of books from which a selection may be made. All of these books have been found useful in the education of salesmen.

LIST OF BOOKS

Title	Author	Publisher
(1) Psychotherapy	James J. Walsh, M.D., Ph.D.	D. Appleton & Co.
(2) 25th Annual Report of Commissioner of Labor		Washington Government Printing Office
(3) Scientific Sales Management	Chas. W. Hoyt	Geo. B. Woolson & Co.
(4) 125 Brain Power Business Manual	125 General Managers, Sales Managers and Sales Authorities	Sheldon University Press
(5) Increasing Human Efficiency in Business	Walter Dill Scott	The Macmillan Co.
(6) English Synons., Antonyms and Prepositions	James C. Fernald	Funk & Wagnalls
(7) Choosing a Vocation	Frank Parsons	Houghton Mifflin Co.
(8) Practical Salesmanship	Nathl. C. Fowler, Jr.	Little, Brown & Co.
(9) The Junior Partner	Edw. Mott Woolley	E. P. Dutton & Co.
(10) Old Squire	B. K. Benson	The Macmillan Co.
(11) The Efficient Life	Luther H. Gulick	Doubleday, Page & Co.
(12) Modern Organization	Chas. DeLano Hine	The Engineering Magazine Co.
(13) Electricity — Its History and Development	Wm. A. Durgin	A. C. McClurg & Co.
(14) Essentials of Psychology	W. B. Pillsbury	The Macmillan Co.

(15) The Pickwick Papers	Charles Dickens	E. P. Dutton & Co.
(16) Friendly Talks to Managers	P. V. Burn	The Caxton Society
(17) The Story of Candlesticks	Victor Hugo	The Caxton Society
(18) Emerson's Essays, Nature and Friendship	Ralph Waldo Emerson	The Caxton Society
(19) The Law of Mental Domination	Thos. E. Dockrell	Commercial Pub. Co.
(20) Compensation	Ralph Waldo Emerson	Barse & Hopkins
(21) Better Sales Service	Norman Craig	
(22) Writing the Short Story	J. Berg Eisenwein	Hinds, Noble & Eldredge
(23) Hutchinson's Handbook of Health	Woods Hutchinson, A.M., M.D.	Houghton Mifflin Co.
(24) Psychology	William James	Henry Holt & Co.
(25) The Psychology of Advertising	Walter Dill Scott	Small, Maynard & Co.
(26) Psychology and Industrial Efficiency	Hugo Munsterberg	Houghton Mifflin Co.
(27) Efficiency as a Basis for Operation and Wages	Harrington Emerson	Engineering Magazine
(28)) Twelve Principles of Efficiency	Harrington Emerson	Engineering Magazine
(29) The Education of the Will	Jules Payot, L.D., Ph.D.	Funk & Wagnalls
(30) Elementary Electricity and Magnetism	Dugald C. Jackson, C.E.	The Macmillan Co.
(31) Influencing Men in Business	Walter Dill Scott	Ronald Press
(32) The Writer's Desk Book	Wm. Dana Orcutt	Fred'k A. Stokes & Co.
(33) Imagination in Business	Lorin F. Deland	Harper & Bros.
(34) The New Industrial Day	Wm. C. Redfield	The Century Co.
(35) Mind and Work	Luther H. Gulick	Doubleday, Page & Co.
(36) The Psychology of Public Speaking	Walter Dill Scott	Pearson Bros.
(37) The Theory of Advertising	Walter Dill Scott	Small, Maynard Co.
(38) Personal Power Counsels to College Men	Wm. Jewett Tucker	Houghton Mifflin Co.

(39) Human Efficiency	Horatio W. Dtesser, Ph.D.	G. P. Putnam's Sons
(40) Hygiene	Wm. H. Burnham	The McMillan Co.
(41) Elementary Principles of Electricity and Magnetism	Hough and Boehm	The Macmillan Co.
(42) Concentration—The Secret of Success	Dr. J. Seton Sears	Edw. J. Clode
(43) The Psychology of Salesmanship	Wm. Walter Atkinson	Elizabeth Towne Co.
(44) Power of Will, Personal Atmosphere	Frank Channing Haddock	The Pelton Pub. Co.
(45) Getting the Right Start	E. St. Elmo Lewis	The Caxton Society
(46) How to Write a Business Letter	Charles R. Wiers	
(47) Electrical Meterman's Handbook		N. E. L. A.
(48) Psychology	Charles H. Judd	The Macmillan Co.
(49) Electricity of Today	Charles R. Gibson	Seeley Serv. & Co., Ltd.
(50) Elements in Industrial Organization	Edward Cadbury	Longmans & Co.
(51) What to Read on Business		The Business Book Bureau
(52) The Human Machine	Arnold Bennett	Geo. H. Doran Co.
(53) Mental Efficiency	Arnold Bennett	Geo. H. Doran Co.
(54) Education	Herbert Spencer	Brentano's
(55) Electric Power Transmission	Bell	
(56) Thoughts on Business	Waldo P. Warren	
(57) Electricity, Experimentally and Practically Applied	Sydney W. Ashe	D. Van Nostrand Co."

In its investigations your Committee formulated a list of questions which was sent to representative men of the larger companies with the idea of getting some definite statements on the subject at hand. Following are the results of these questions.

Question No. 1

What do you consider the principal qualifications for a successful central-station salesman? Please name them in the order of their importance.

Answer

(1) Physical efficiency—health, hygiene, recreation.

(2) Self-development—imagination, initiation, power of selection, ambition, concentration, honesty, energy, enthusiasm, judgment, etc.

(3) Inspirational—right thinking, test of efficiency, confidence, courage, self-analysis, development of will power, etc.

(4) Knowledge of his business—analysis, comparison, demonstration, explanation, impressiveness, responsiveness, sympathetic service, belief that no sale is rightly made unless satisfaction follows.

Question No. 2

In your opinion does the technically trained college graduate make a better salesman, after having the practical experience, than the man whose electrical training was obtained by experience and self-education?

Answer

This question was asked of several responsible employers. The answers were unanimous that, all other things being equal, advantage lies with the college man.

Question No. 3

Do you select your salesmen with a view of their being qualified to advance to higher positions in the company later on, or for their qualifications as a salesman only with the idea of their remaining salesmen?

Answer

All replies received to this question signify men are employed with a view to their advancement.

Question No. 4

What are the average earnings of your salesman for the first year and the second year in the different classes as follows: Light salesmen, Power salesmen, Appliance salesmen, Salesmen on large lighting and power?

Answer

The answer is arrived at by figuring the average of replies received.

$75 per month to 1st year light salesmen
$85 “ “ “ 2nd “ “ “
$80 “ “ “ 1st “ power “
$90 “ “ “ 2nd “ “ “
$60 to $100 per month to appliance and material salesmen

Question No. 5

Are you able to get men for the higher positions in your company from your employees, or are you obliged to go outside for them?

Answer

Replies are practically unanimous that high positions can be and are acceptably filled from among the ranks.

Question No. 6

What do you consider the minimum educational requirements for men to be trained as salesmen with a view of their probable future advancement?

Answer

The average minimum education desired by the companies answering this question is the high school, but several answers indicate that a lower standard of public school supplemented by technical or other special training often proves acceptable; much depends on the ambition of the employees.

Question No. 7

What method do you use to educate your salesmen?

Answer

Large companies only who have already started educational work among their employees answered this question. Replies have been printed in full.

Question No. 8

What is the average length of service of a salesman in your company? If you have found this average length of service to be short, what, in your opinion, is the reason for it?

Answer

Average length of service is satisfactory.

Question No. 9

What percentage of your salesmen are university men?

Answer

Manufacturing companies—from 75 to 100 per cent; central stations—from 5 to 15 per cent.

Your Committee discussed at length the advisability of recommending to the Association the establishment and operation of a Correspondence School, and a supplemental report will be made at this Convention on this subject, recommending the establishment of correspondence courses by the Commercial Section of the National Electric Light Association.

The work of this Committee is closely related to that of the Commercial Section of the N. E. L. A., and it is suggested that this Committee act as counselor in the solving of central-station problems for those not as yet equipped with educational courses, to recommend specific programs and means and methods applicable to their educational requirements.

Committee
GEORGE WILLIAMS, *Chairman*
SYDNEY W. ASHE
R. H. BALLARD
J. A. BRITTON
JOHN F. GILCHRIST
F. C. HENDERSHOTT
C. A. HOWLETT
A. LARNEY
H. D. SHUTE
GLEN C. WEBSTER
FRED R. JENKINS, *Secretary*

ON THE TRAINING OF COMMERCIAL MEN FOR CENTRAL-STATION WORK BY CORRESPONDENCE

The Sub-Committee of the Committee for the Education of Salesmen to which was referred the question of training by correspondence, has met and reports as follows:

It is believed that the most efficient way of training commercial students is by means of personal direction rather than by correspondence. The Committee appreciates, however, that there are a large number of central stations which, on account of the limited territory in which they operate, will not be able to carry on a course of training under personal direction and it is therefore recommended that in such cases the training be done by correspondence.

Plan

The plan in general consists of the preparation and printing of a series of general lectures, questions and answers and the preparation of a list of reference books to be studied. The two text-books recommended are the Electrical Solicitors' Handbook and the current Report of the Commercial Section of the National Electric Light Association. The general lectures should serve to introduce a human interest in the study of the subjects covered in the text-books mentioned.

The work of preparing the lectures, questions and answers and their distribution, correction and return, could be in charge of a Director of Education, whose work would be directed by the Committee for the Education of Salesmen and who should preferably be located in the General Offices of the Association at New York.

Cost

Assuming that a sufficient number of member companies subscribe to the course of training, to make a total of 1000 students, it is believed the course could be offered to the member companies at $10 per student.

Plan of Operation

All correspondence between the Director of Education and the students should be through an executive of the member company subscribing to the course, or his assistant, the object being to see that the one to whom the student is directly responsible in his other activities, displays an interest in the progress and work of performing the duties outlined in accordance with the established schedule. Such a plan, it is believed, will assure the successful completion of the work.

It is recommended that the contemplated course of instruction be offered to member companies only and that the students themselves shall have no financial relation with the Association.

Respectfully submitted,

C. A. HOWLETT, *Chairman*

MR. C. A. HOWLETT, Schenectady: My ideas on the subject are entirely in accord with these outlined in the report. I do not think I can add anything to the Report, but I shall be glad to answer any questions the members desire to ask.

Mr. F. D. Beardslee, St. Louis, Mo.: I would like to know whether the Committee has any scheme for advancing the salesmen's salaries upon graduation according to the ability shown by them.

Mr. Howlett: That subject was not discussed at the committee meetings I attended, but it seems to me that the policy of some of our well-established companies should be adopted, and that is to have an established rate at which the men shall all start in. At the end of a fixed trial period, say, possibly six months, it could be decided whether or not a commercial man has made the progress expected, and if entitled to an increase in salary, this increase would be definitely stated, possibly, say, $100 a month. If at the end of the year another increase is to be made, that, too, should be a definite amount, on up to possibly $125 a month. Having these rates established for the end of definite periods, the man in charge of this matter could give his time to something besides discussing possible increases in salary.

Mr. B. W. Mendenhall, Salt Lake City: I would like to ask Mr. Lloyd a question which I believe will be of general interest. Some of the graduates of the University of Utah have asked me what I would recommend for them to do after graduation. I have suggested that possibly they might be able to make arrangements with Mr. Lloyd to enter the Institute which he and his associates have established in Chicago, and get a commercial education along the line of central-station work, which would enable them to take a position with our company or some other company of the kind. They ask if Mr. Lloyd's graduate school entails any obligation upon a man to remain in the service of the Commonwealth Edison or its allied companies after graduation.

Mr. E. W. Lloyd, Chicago: It does not.

Mr. Mendenhall: A man can enroll and receive partial compensation while attending school?

Mr. Lloyd: Yes.

Mr. Mendenhall: Then I want to say that that is a very liberal proposition on the part of the Commonwealth Edison Co.

Mr. Lloyd: Well, we are getting experience now; we may have to change our tactics later.

MR. R. B. SNYDER, Milwaukee: I would like to ask some of you gentlemen what salary a student is worth? Have you considered a salary and commission basis? How would that work out?

MR. LLOYD: In Chicago, we pay all our salesmen a salary and commission. Students have that privilege, the privilege of earning a commission, but the percentage of commission with that class is necessarily small, and if they do earn something, they are showing their worth and are the kind of men we want. I presume those men would advance more rapidly than would others who are incapable of earning a commission.

MR. A. C. EINSTEIN, St. Louis: Commenting on the Report that has just been read, I believe the question of educating salesmen as between a commercial or manufacturing institution and a central station is a materially different one. A salesman who can sell machinery and things of that kind may possibly not possess the temperament and qualifications to get a contract for electricity. I also believe that the ability of most salesmen is limited to certain fields of work. A man may be able to solicit and get residence or industrial or commercial business and yet not be able to get all three. He is usually competent and successful in one line only. In our company we separate salesmen into three classes: residence, industrial and commercial. We divide our educational classes in the same way; first residence, then commercial, then industrial. When I first took hold in St. Louis we started an educational course, since it occurred to us that to take a salesman and put him out to talk to a customer without first giving him some training, was rather a crude method of operation. A salesman attempting to sell shoes, for instance, would not be competent to sell shoes without knowing something about the business. A salesman, in years gone by, was generally any man who could get a job at any salary he could work the sales manager for, and there was no systematic way of handling him. The head of the sales department is the man who must know how to handle the men. He can do more than any school to educate his salesmen. The idea set forth in this paper of establishing a general educational scheme all over the country, I do not think could be well worked out. Local conditions would govern many things that a salesman has to know.

THE CHAIRMAN: We all know the difficulty Mr. Einstein has pointed out of getting men for the different grades of our selling force.

MR. L. A. FERGUSON, Chicago: It occurs to me to ask if the Committee has considered the giving of an opportunity for study to young fellows coming into the office as office boys and junior clerks. They do not have a chance, perhaps, for study to prepare themselves for sales positions.

MR. HOWLETT: The Committee did not differentiate between the prospective and the present employee. It is rather up to the present employee to get the necessary foundation. He can do that just as well while in the employ of the company and perhaps better than the outsider. He has the same opportunity and perhaps more.

MR. BEARDSLEE: In connection with the subject under discussion I would like to say that in St. Louis we have the three classes of men Mr. Einstein has mentioned. They are graded. Every male member of the organization must attend the first class—the sales organization class. The office boys go to these classes and it is a pleasure to note that in some cases the boy will learn more quickly than some of the older clerks. It is in these classes that we find and learn to know our men.

We have a scheme of advancement on a merit system. We do not run on a commission basis, but a man is allowed a certain number of points for a new contract, for kilowatt capacity, and for revenue per year; and we can allow the points for any subject that we want to push for the moment. We have found it necessary to allow more points for the displacement of the so-called gas-arc lamps than for anything else. We have a bulletin board in the sales department on which is posted each morning the number of points earned by the men the day before, and the total points for the month to date. The salesmen watch this board as though they had money up on a horse race. There is a bonus paid each month to the highest man, a smaller bonus to the second man, and one to the third, and the fourth, and on down. In the way of advancement, increases in salary, and so on, we take the men from the first or primary class, when ready for the second class, and then advance them. In the event of getting a new man who has had prior experience and is a better man than some we have had for two years or more, if he can pass an examination from the first class to the second we advance him two years in the service of the company, and a man is graded in salary according to the number of years he has been with the company, and in addition has the bonus payments on merit points. As they are graduated we always have positions in one or the other departments which pay a higher salary. Residence men are paid less than industrial power men and commercial men.

These classes are carried on by our engineering salesmen of the industrial power department. The teachers are graduate engineers, while our examinations are handled by what we call the Faculty, consisting of teachers, sales managers and assistant sales managers. We have Faculty meetings and lay out our course of studies, including examinations, and those who pass from class to class do so under a critical examination before the Faculty. They are asked questions and are required to give a demonstration of their ability by selling us power, or light or anything else we see fit to designate. If they can pass that examination they go into the next class and are then in line for advancement.

THE CHAIRMAN: I agree with Mr. Einsten that the large companies have a problem different from that of the smaller companies. The large companies have different classes of men, but in the small companies the men are required to know more than house lighting or commercial lighting; they have to cover a wider field. I would like to hear from somebody who has had experience along the latter line.

MR. L. H. SCHERCK, Poughkeepsie, N. Y.: I have had some experience in both large and small companies. Just above New York we have recently consolidated a number of smaller companies, and I find that what the Chairman has just said is very true. The men in the smaller companies are required to know a great deal more than the salesmen in the large companies. We have been much disappointed in selecting men from some of the larger companies and paying them high salaries, only to find that we had drawn a "lemon." Sometimes they make good; oftener they go back to the larger companies and succeed there, and the reason they fail with us is that out in the districts where the smaller companies operate the salesman is really looked upon as a sort of general manager. He is supposed to know a good many things that the specialist of the larger company is not called upon to know; he is a man of a different grade. I was interested in the statement that many college men come out of school with false ideas of the position which they should take after graduation. I have a little story which I told several years ago at one of the conventions here in Chicago, and some of you who were here may remember it, but it will serve as an illustration. It is a story of my own experience in applying for a position in 1894. I had just finished college, in fact, I had been on the Faculty of the university, and had an exalted idea of my own ability. I walked into the office of a superintendent and I told him about the several degrees I had taken in college and how I had served on the Faculty. "Well, young man," he said, "I will not hold all that against you."

Mr. Einstein remarks that you cannot run a correspondence course with benefit to the central station, but, with all due respect to Mr. Einstein, I do not think he is right so far as the small central stations are concerned. As a matter of fact, very often the fair general manager, the fair executive or the fair sales manager of a small company is in need of that very instruction himself. Even here in this Convention it is apparent. We know that the speaker who gets the floor usually represents one of the larger companies. We hear generally of Mr. MacSweeney, of Rochester, of Mr. Gilchrist, or Mr. Lloyd, of Chicago, or Mr. Williams, of New York, and the smaller fellows keep quiet, because they are afraid to get on their feet. The problems of the smaller stations go by the board because there is nobody to say anything, although the larger companies do not need anything like as much assistance as the smaller. If you had to go about and look at the way some of the smaller companies are managed you would wonder that they are able to earn any dividend at all. We used to take these small companies out of the hands of receivers and make them profitable just because we were able to analyze conditions and employed modern methods—could see gold dollars where the local men thought the property valueless. I might say, however, that there is not as much of this to-day as a few years ago, since the smaller companies very frequently profit by using modern methods and getting trained men to do these things for them, rather than a syndicate which always wants a percentage of the profits.

I would like to recommend heartily the plan that has been suggested here for some sort of a correspondence course, supplemented naturally by local work. It is well not to forget that the sales manager and even the general manager will, very often, receive a lot of benefit themselves.

THE CHAIRMAN: The next number on the program is the Report of the Committee on Electrical Merchandising, Mr. T. I. Jones, of Brooklyn, Chairman.

REPORT OF THE MERCHANDISING COMMITTEE

PURPOSE

The purpose of this report is to present a policy and some methods that may be advantageously utilized by central stations generally in the sale of appliances.

INTRODUCTORY METHODS

The development of household electrical devices is a matter of comparatively recent date. The business of the majority of central stations was, until the past few years, limited to the sale of electrical energy. With the advent of the electric iron and successively of other household devices it was natural that the companies should consider the exploitation and sale of these appliances purely from the standpoint of additional current consumption and the popularization of service.

Goods were frequently sold at cost or less. Merchandising methods were not considered. Little heed was paid to the advantages of encouraging the sale of these appliances by contractors, supply houses, etc. In fact, prices were generally made with which such agencies found it impossible to compete.

In an industry such as ours, where the co-operation of manufacturers, contractors and supply houses is highly desirable, and which is so progressive as to be satisfied with the application of nothing short of the very best business methods, such a policy, which was probably justified in the early stages of appliance development, must necessarily prove but temporary.

THE MODERN TENDENCY

A marked tendency has been shown in the last two or three years to depart entirely from this initial plan of campaign, to take all the agencies involved into careful consideration, to abandon what might be called the central-station method in the sale of appliances, and to adopt modern merchandising methods in this department of our business.

Nearly all the companies in the large cities have to a greater or less extent operated their appliance departments during the last two or three years on a modern merchandising basis.

The result has been highly gratifying. Not only have they been enabled to sell more appliances than they would have in the old way, but they have encouraged the sale of appliances by dealers, so that the net result has been a much larger and more general distribution of these devices, which is, of course, the main object desired.

THE POLICY RECOMMENDED

Your Committee feels that it cannot too strongly recommend the sale of appliances by central stations on a merchandising basis at a fair profit according to local conditions. It will be found in the majority of cases that sufficient profit may be made from the sale of appliances to carry this branch of the business, and in many cases to show a clear gain over all expenses. At the same time much friction is eliminated from quarters where co-operation is desired and of advantage. If the central station is going into the merchandising business, it should do so on a merchandising business basis, and so eliminate friction, encourage co-operation and develop the largest number of depots or agencies for the sale of electrical devices.

In the merchandising of appliances there are three main factors: Buying, selling and accounting; and this report will deal with the subject under these three divisions.

BUYING

Your Committee is of the opinion that the initiative for purchase of appliances should come from the Sales Department, requisitions being issued, as is customary with central stations, through the Purchasing Department.

Your Committee is also of the opinion that in order that all companies shall be placed on an even footing in the purchase of appliances, each manufacturer should sell current-consuming devices to central stations on a printed form of contract with discounts varying according to quantity, no deviation to be made from this printed schedule.

The majority of the members of your Committee are of the opinion that it is not generally advisable for large central stations to handle the goods of any one manufacturer exclusively. Your Committee, however, recognizes that this matter is one containing so many variable factors that in many cases it must be decided by a consideration of local conditions.

SELLING

LOCATION

In merchandising appliances the advantages of an adequately equipped store in a central location are obvious. People "go where the crowds go," and it is exceedingly difficult to induce them to leave the main trend of traffic for a side street or obscure location. A number of central stations with offices away from the main retail district or street, have found it advantageous to open electric shops in retail centers, where a much larger business has been done than in the old office headquarters, and in addition the advertising feature is one worthy of consideration.

Application Desk and Cashier at Rear of Appliance Salesroom.
"There's a Reason"

Wherever located, it is of advantage to have the application desk and cashier's cage established in the rear of the appliance salesroom, so that customers in applying for service or in paying their bills, may not fail to see the display of electrical devices.

Wherever located, the appliance bureau, under whatever name, may be most advantageously operated as part of the Sales Department.

THE COST OF DOING BUSINESS

No merchant may continue to exist, unless he obtains on the sale of his goods a profit over and above the cost of doing business, and if the central station is to adopt merchandising methods its fundamental basis of policy must be the establishment of prices which will produce a profit over all costs. In order to do this, it is obvious that there should be some standard or general understanding as to what constitutes central-station costs in doing an appliance business. Your Committee is of the opinion that the items which should be included by us in the cost of doing business are as follows:

(1) Administration cost. (Such percentage of the cost of management of the entire company as may be properly applied to this department.)
(2) Rental value of space.
(3) Appliance advertising. This should be apportioned on a basis of approximately 75 per cent of the cost of the appliance advertising; the other 25 per cent being properly chargeable to general publicity.
(4) All appliance shop labor, including collection expense.
(5) Delivery expense.
(6) Depreciation on stock and fixtures.
(7) Bad debts.

What percentage of the cost of appliances should be the total cost of doing business? In other words, how much must be added to actual cost price of appliances before we arrive at a gross cost which may properly be used as a basis upon which to calculate profit? Upon this subject your Committee addressed inquiries to a number of central stations, contractors, supply houses and department stores. The answers varied from 15 to 33 1/3 per cent.

One large department store states that: "In a department store, the actual cost of doing business will not deviate very much one way or another from 27 per cent." A large electrical supply concern in New York gives the cost of doing business to the electrical jobber or dealer as 20 per cent. An electrical concern conducting a general supply and contracting business in the same city, states: "We have computed our overhead cost (including such items as rent, light, telephone, advertising, postage, salaries of office and executive staff, etc.) to be about 27 per cent on the amount of business we have done in the past two or three years. This may seem a high rate, but we feel it is correct, since we have kept our records very carefully." A responsible and successful electrical contractor gives his overhead charges as 18.2 per cent.

The average cost of handling the retail business of electric jobbing houses, figured upon the basis of a large number of replies to inquiries, is about 22 per cent of the gross sales, figured on a basis of selling price of the goods. It would appear, therefore, if the central station is to do business on a basis which shall encourage the contractor, the jobber and other agencies to co-operate in the extension of this market, that it should figure to make a profit over all cost of at least 33 1/3 per cent on retail sales. This does not mean that all goods must be sold at an advance of 33 1/3 per cent above cost. There are certain articles of seasonal sale, such, for instance as Christmas tree lighting outfits, upon which a much higher rate of profit may properly be charged. There are other lines which for various reasons may be priced at a lower profit. but if we are to do business on a merchandising basis with the marked advantages which must accrue therefrom, the average profit should be not less than the percentage indicated.

SALES ON INSTALLMENTS

The sale of appliances on the installment plan seems to be a growing practise among central stations, but there is no standard of usage as to an additional charge made for the use of the company's capital. Some companies in selling appliances on the installment plan charge the same prices as they would for cash. Other companies fix their prices upon the installment basis and then deduct a percentage, usually from 6 to 10 per cent, for cash. Still other companies add varying percentages to cash prices where payments are deferred.

Your Committee, having obtained information concerning the practises of a great many companies, and after having given the matter very careful consideration, is of the opinion that where goods are sold on time, 1 per cent per month may properly be added to the original cash price for as many months as the payments are deferred. For instance, a sale of $100 on ten months' credit would call for a total payment of $110. This method is now in use by the Edison Electric Illuminating Co. of Boston.

A merchant cannot afford to lend his capital along these lines for a lesser return, and there is no reason why the central station should cut under the merchant in this feature of merchandising.

ISSUING APPLIANCES ON TRIAL

The replies of a number of large companies to inquiries concerning their practises in sending out appliances on trial are very interesting. One company says: "It has been our practise in the past to consign nearly any article (with the exception of heating pads and electric fans) and the trial period would range from one to thirty days. During the past year, however, the only articles delivered on trial for approval have been such as would show very slight depreciation. The electric iron we are always glad to consign for a period of three or four weeks and sales resulting from such consignments have averaged about 46 per cent."

Another company says: "All heating and other apparatus, not including heating pads, milk warmers, curling irons or any sanitary articles which may become infected by indiscriminate use, are sent on trial to prospective purchasers for a period of from one to four weeks. The demonstrator is, after a reasonable length of time, sent to the house, and she uses her efforts to make the sale."

Still another company in one of the largest cities in the country, says: "This company has discontinued sending out articles in general on trial; that is, we do not do so except in such cases as flat iron campaigns or special plans for introductory purposes. Our present practise is to sell articles outright and tell the customers that if they are not satisfactory we shall be glad to take them back and render full credit provided they have not been injured or rendered unsalable by use. This is a very fair proposition and we find that it operates successfully and comes within the general methods of the best merchandising in other lines of business."

An eastern company which operates over a large territory, says: "We have always sent out electric irons on 30 days' trial. We have in some instances sent out electric toasters on two weeks' trial. We have not found this very satisfactory in regard to the condition of the toaster when it is returned. We also find that some of our customers do not like to receive a toaster that they think some one else may have had on trial. For these two reasons we now demonstrate a toaster only in a customer's home. We do not leave it on trial except in some very special cases. We send out no other appliances on trial."

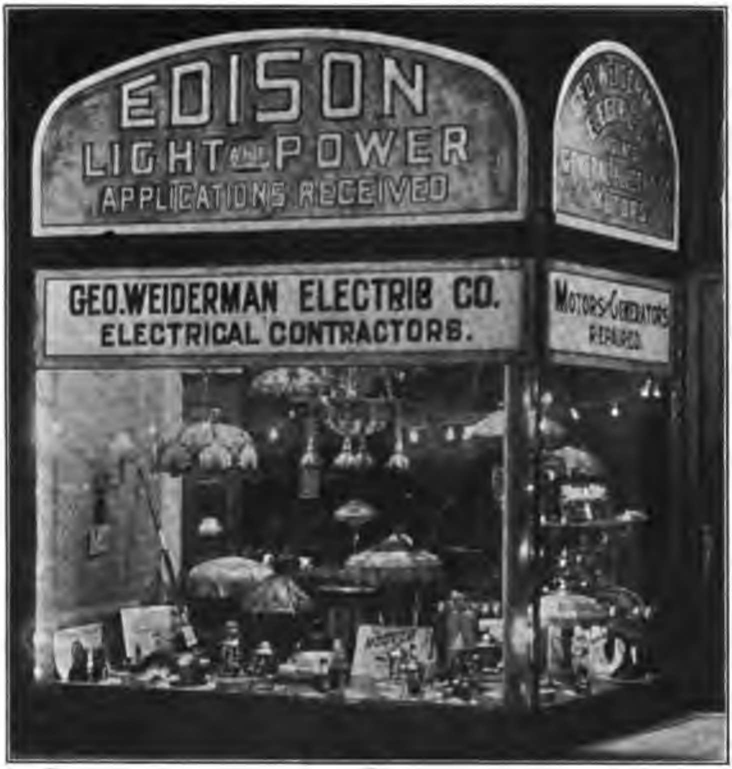
After careful consideration of all the factors that enter into this situation and of the information and varying opinions received, this Committee recommends that goods sent on approval should be largely limited to irons, and that if other appliances are issued on trial for short periods, they should in no case include any types of appliances trial use of which is likely to materially depreciate the article or produce unsanitary results.

PLANS FOR INCREASING APPLIANCE BUSINESS

It is considered appropriate to include in this report mention of certain methods of merchandising appliances utilized by some of our member companies, which have proven effective and may possibly be applied successfully by other companies.

Contractor's Window Plan—In connection with the encouragement of electrical contractors to co-operate with the central station, and as an example of what is proving an effective method of developing a considerable number of widely distributed appliance sales rooms, the "Contractor's Window" Plan, in use by the Edison Electric Illuminating Co. of Brooklyn, is of interest.

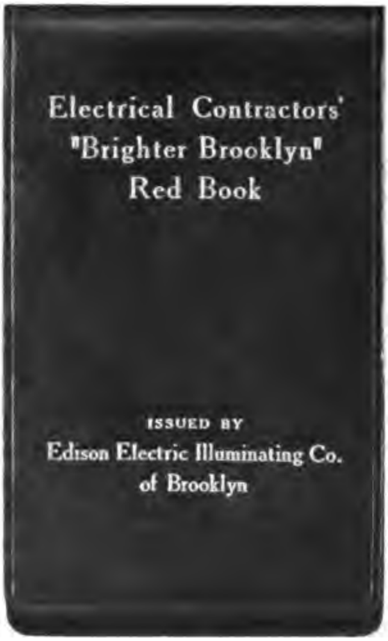
The company paints upon the windows of any contractor who has an adequate store in a good location, a translucent sign, reading: "Edison Light and Power. Applications Received." The contractor wires the windows for the number of lamps specified by the company, with a control switch on the outside of the premises. The company lights these windows free of charge on its regular advertising lighting schedule, from dusk to midnight. This makes the contractor in a very real sense an agent or intermediary of the company, resulting, in connection with other co-operative plans used by this company, in greater harmony and more business. The company supplies the contractor with adver-



Co-Operative Window of Brooklyn Edison Co. and Electrical Contractor

Window of Electrical Contractor in Brooklyn's "Ghetto" District tising, if he so desires, and a "lead" book, through which he may obtain prompt information for his customer concerning any complaint or inquiry.

Window Displays—The Brooklyn company encourages the contractor to maintain an adequate appliance salesroom, not only by establishing standard prices but by aiding him in obtaining and displaying appliances to the best advantage. In this connection it is felt that the show window display, which is an exceedingly effective method of advertising, is now frequently inadequate and that anything that may be done to encourage, improve and raise the standard of this kind of publicity, would certainly prove advantageous in increasing the sales of electrical appliances. The Committee recommends to central stations and to manufacturers the serious and comprehensive consideration of this valuable method of co-operative advertising.

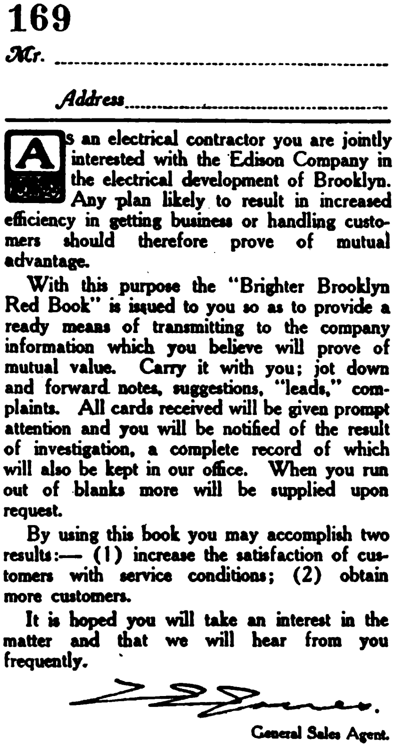


Electrical Contractors'
"Brighter Brooklyn"
Red Book

ISSUED BY
Edison Electric Illuminating Co.
of Brooklyn

COVER OF CONTRACTOR'S "LEAD" BOOK

Popularizing the "House Electric"—In connection with its appliance and fixture salesroom, which it calls the "House Electric," the Consolidated Gas, Electric Light & Power Co., of Baltimore, offers the use of this "House" without charge and with very few restrictions, to charitable organizations, for holding fairs and entertainments. In several cases these have lasted for three days in succession. In a report to the Committee on this subject the Consolidated Company says: "Of course, it is only the better class of women who apply for this privilege, with the result that we have been of assistance to the leading society women and women of wealth in the community, in their charitable work. In each case we have received pleasing expressions of appreciation from these women, and the 'House Electric' has



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Mr. ....

Address..

As an electrical contractor you are jointly interested with the Edison Company in the electrical development of Brooklyn. Any plan likely to result in increased efficiency in getting business or handling customers should therefore prove of mutual advantage.

With this purpose the "Brighter Brooklyn Red Book" is issued to you so as to provide a ready means of transmitting to the company information which you believe will prove of mutual value. Carry it with you; jot down and forward notes, suggestions, "leads," complaints. All cards received will be given prompt attention and you will be notified of the result of investigation, a complete record of which will also be kept in our office. When you run out of blanks more will be supplied upon request.

By using this book you may accomplish two results:— (1) increase the satisfaction of customers with service conditions; (2) obtain more customers.

It is hoped you will take an interest in the matter and that we will hear from you frequently.

General Sales Agent.

INTRODUCTORY EXPLANATION PAGE CONTRACTORS' "BRIGHTER BROOKLYN" RED BOOK become a popular topic of conversation in the homes of our leading citizens. The direct result of this upon our sales cannot be definitely traced."

Appliance Canvassing Campaigns—Last year this same company inaugurated an agressive house-to-house canvassing campaign for the sale of appliances, employing 15 special canvassers. These were paid a salary of $10 a week, and 10 per cent commission on all sales over $60. They carried samples of the most popular appliances in a neat suitcase. The campaign lasted three months and the company reports that the results were so satisfactory that they intend to start a similar campaign this year which shall last five months instead of three.

Appliance Sales by "Light" Salesmen—The question as to how far the regular lighting and power salesmen of a company may be used to advantage for the sale of appliances is an important one. There is little doubt that in most companies the salesmen could be utilized to some extent in the sale of appliances, without interfering with their regular line of work. The best method of accomplishing this result must be worked out by each individual company according to local conditions.

The Commonwealth Edison Co., of Chicago, has in operation a system whereby the light and power solicitors are interested in the sale of appliances to such extent that they send a great many customers to the Chicago "Electric Shop," for which they receive small commissions. During October, November and December, 1912, 306 orders, amounting to $2,646.45, were obtained in this way. Each salesman of the company is given a loose-leaf pocket booklet which is a comprehensive catalogue of the electric appliances for sale at the "Electric Shop," giving all required details of use to salesmen in disposing of these goods. The salesmen are also furnished with a duplex card, copy of which is herewith shown, the upper half being given to the customer by the salesman as a card of introduction, the lower half forwarded by the salesman to the manager of the "Electric Shop." If sales result within 60 days, commission is paid to the salesman making the introduction. Salesmen are also given merchandise order cards for use when orders are taken on customers' premises. The experience of the Commonwealth Company is, however, that the light and power salesmen do not take many direct orders for appliances, but have been successful in inducing many customers to buy appliances at the "Shop."

Sample Pages of Appliance Catalogue and Data Book Issued by the Chicago Electric Shop to the Light and Power Salesmen of the Commonwealth Edison Co.

No. **10823** Date, ____________ 191__

To the Manager, Electric Shop.

Kindly extend to

M ______________________

who presents this card, every possible courtesy and attention.

Signed ______________________

Commonwealth Edison Company.

No. **10823** Date, ____________ 191__

Name ______________________

Address ______________________

Article ______________________

Signed ______________________

Commonwealth Edison Company.

Card Given to Light and Power Salesmen by Chicago Electric Shop

Reverse of Introduction Card Supplied to Salesmen

PRESERVE THIS CARD

When presented at ELECTRIC SHOP, Jackson and Michigan Boulevards, this card will assure the special attention accorded to users of Commonwealth Edison Company's service, as requested on the back hereof.

W. H. BUCHANAN

Contract Department,
Commonwealth Edison Company.

This Card to be detached, and, after being properly filled out on the back hereof, to be sent to

Manager ELECTRIC SHOP
Room 936, Railway Exchange Building
Jackson and Michigan Blvds.
CHICAGO

ADVERTISING

This report will touch but lightly upon the important subject of appliance advertising. The extent of advertising and publicity that may be afforded in connection with the sale of appliances, and just what methods are likely to prove most efficacious, are frequently local problems. The great value of judicious, attractive, properly directed advertising is now generally recognized. Manufacturers have issued during the past few years some exceedingly attractive and efficient advertising literature for use by central stations in the sale of appliances, and this has been and can be used in a great many cases to excellent advantage. Sometimes, however, the prices quoted in manufacturers' literature are embarrassing to the central station, interfering with or preventing the distribution of what would otherwise be valuable circulars or booklets.

Your Committee recommends that in advertising literature supplied by manufacturers, if any price be stated it shall be the net selling price.

Sometimes manufacturers apply to the central station for lists of customers for advertising or sales purposes. Your Committee deems it generally inadvisable to supply such lists, but considers that within reasonable limits any central station should be willing to distribute manufacturers' advertising if it meets local needs and conditions.

While it is not primarily an advertising matter, this is probably the most appropriate place for a recommendation of the Committee to the effect that manufacturers should supply with each appliance sold a neat card with concise directions as to how to use it.

The question as to the advisability of distributing advertising with monthly bills is one which has of late received considerable attention. This is an inexpensive method of advertising and your Committee deems it advisable, but the practise of loading mail with printed matter is deprecated, one piece of literature in any enclosure being considered sufficient.

REPAIRS

In connection with the merchandising of electrical appliances on any large scale, the matter of repairs frequently assumes considerable importance. Prompt repairs on defective or returned appliances are essential for the success of any appliance business, and the Committee recommends to manufacturers the providing of adequate facilities for prompt repairs, it being understood that the central stations or other supply dealers shall handle light repairs calling for no replacements. Regarding replacements, close co-operation should exist between the local dealer and the manufacturer.

DELIVERY

Wherever the nature and extent of the business will warrant, the central station should make its own deliveries and show by example its faith in the electric delivery wagon.

Regarding the delivery of trial irons, a number of methods are in use, nearly all of which are familiar. The practise of sending irons by express or parcels post, to be followed within two or three days by a demonstrator, is growing. It has some distinct advantages. One company delivers trial irons to a new installation at the same time the meter is delivered, thus eliminating the expense of special delivery for the iron.

ACCOUNTING

The object of your Committee in presenting this section on appliance accounting is to recommend some simple method of keeping track of transactions which may be advantageously utilized by a majority of the member companies. Some of the larger companies have elaborate systems of appliance account and audit, frequently requiring a large number of forms and considerable bookkeeping, but the method suggested in the following would seem to meet the needs of the average company.

Appliance accounting naturally resolves itself into two divisions: (1) a means for keeping simple and accurate record ot stock and (2) a method of keeping account of cash or charge sales and of consignments.

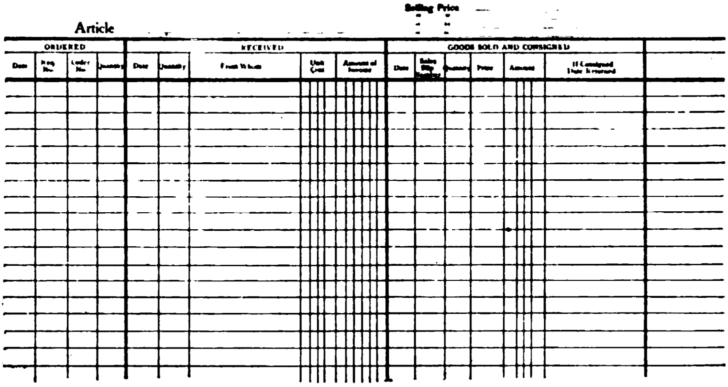
STOCK RECORD

The most convenient form of keeping record of stock is either by means of a loose-leaf ledger or by stock cards. It is believed that the cards have a slight advantage over the loose-leaf sheets, insomuch as they are more easily indexed and not so cumbersome. The report, then, will deal with the card system method.

A card should be made out for every type of article kept in stock by the Appliance Bureau or Electric Shop. It should be divided into three sections: Material ordered, material received and goods sold or consigned.

Goods Ordered—This section should cover the date, requisition number, order number and quantity.

Goods Received—This section must record the date, quantity, from whom received, the unit cost and the amount of invoice. Under this division come all goods received, whether from manufacturers or back from consignment.



Article

Selling Price

ORDERED				RECEIVED					GOODS SOLD AND CONSIGNED						
Date	Req. No.	Order No.	Quantity	Date	Quantity	From Whom	Unit Cost	Amount of Invoice	Date	Sales Slip Number	Quantity	Price	Amount	If Consigned Date Returned	

FORM FOR KEEPING SIMPLE AND ACCURATE RECORD OF APPLIANCE STOCK

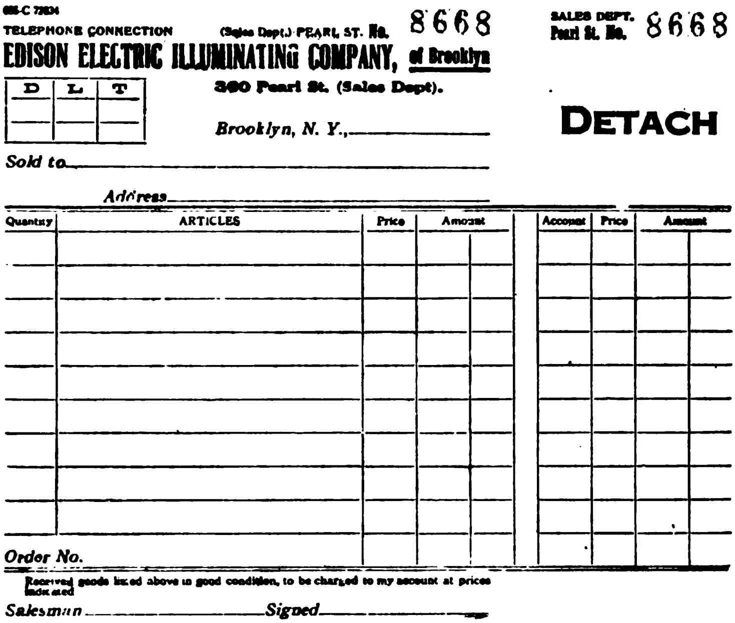
Goods Sold or Consigned—In this division should be registered date, sales slip number, quantity, selling price, total sales, and if the goods are consigned, space should be left for date of return or sale.

It is well to have at the top of this card the selling price to the consumer and enough room allowed for changes which may be made therein. Space should also be left for entry of maximum and minimum stock limits. This reduces the probability of over or under stocking.

CASH AND CHARGE SALES AND CONSIGNMENT DELIVERIES

Most companies find it of advantage to use sales slips made out in triplicate, such as are manufactured by the American Sales Book Co. and the Egry Register Co.

These sales tickets are numbered consecutively and it is thus possible to keep an accurate record of each slip used. When an appliance is sold, charged or consigned, the appliance representative fills out on the registering machine details of sale, giving name of appliance, selling price to the customer, and information as to whether the goods are delivered for cash, or on charge or on consignment.



665-C 72834
TELEPHONE CONNECTION (Sales Dept.) PEARL ST. No. 8668
EDISON ELECTRIC ILLUMINATING COMPANY, of Brooklyn
360 Pearl St. (Sales Dept).
Brooklyn, N. Y.,

SALES DEPT. Pearl St. No. 8668

DETACH

D	L	T

Sold to

Address

Quantity	ARTICLES	Price	Amount		Account	Price	Amount
Order No.							

Received goods listed above in good condition, to be charged to my account at prices indicated

Salesman *Signed*

One of "Triplicate" Sales Slips. This Is Given to Customer as Either Receipt or Bill, According as the Sale Is "Cash" or "Charge." Duplicate to Bookkeeping Department, Triplicate Remains in Appliance Bureau

On the cash and charge sale, the original is given to the customer and is either a receipt for his money or a bill for the amount charged. The duplicate, which is on paper of a different color, is sent to the bookkeeping or billing department and entered against the customer's account. If the purchaser is not a customer of the company, then the charge is entered under miscellaneous sales. The triplicate, which is of different color from the original and the duplicate, remains in the appliance department. From this copy entries are made in the daily sales book, which is indexed to correspond with the sales slip numbers. It has spaces for purchasers' names and addresses and shows the appliance sold, the cost price and the selling price. The cost price, however, does not appear on the original copy which the customer receives on his purchase.

Entries are made on the stock card either daily, weekly or monthly, according to the volume of business.

On consignment deliveries the method changes somewhat. The original sales slip is not given to the consignee but is sent immediately to the billing or bookkeeping department which makes the proper entry. The other two copies, duplicate and triplicate, remain in the appliance department. The demonstrator takes the duplicate copy with her on her visit to the consumer, and on the date the appliance is either sold or returned, she makes entry on this copy. This goes through the regular channel as it would on cash or charge sale, that is, the consignment account is credited and the material is either charged back to stock or against the customer.

CONCLUSION

Your Committee in this report has considered such business methods only as apply to central stations doing their own buying and selling of appliances.

A few large stations do not sell appliances directly, but refer all prospective buyers to the supply houses and manufacturers, limiting the central station's activities to advertising and other means of popularizing electrical devices.

It was felt that at this time the maximum benefit to the industry would be derived by the presentation of a report dealing with methods of direct merchandising—such methods as are utilized or required by the large majority of lighting companies.

While it must be quite evident that every suggestion made in this report cannot be applied uniformly to all member companies, it is hoped that each company will be able to profit by at least some part of the report. The Committee earnestly desires that this report shall arouse liberal discussion at the convention in the belief that the ideas thus developed will form a valuable supplement to the work of the Committee, and will assist in the rapid and efficient progress of merchandising in the electrical field.

Committee

T. I. Jones, *Chairman*
J. C. McQuiston
F. H. Gale
Mathias Turner
C. E. Robertson
W. E. Robertson
D. R. Bullen
Ernest Freeman
G. B. Johnson
T. F. Kennedy
F. H. Kinnicutt
J. B. Murray
H. N. McConnell
S. L. Nicholson
F. B. Rae, Jr.
W. W. Low
M. S. Seelman, Jr., *Secretary*

Mr. Jones (continuing): I might say in illustration of the advertising cards that there was recently a sale of El Toastovos throughout the country. The regular price is $4.00 and during this sale for one day they were sold for $2.00. We got out a card and sent it to all our customers, stating that we were going to sell this appliance for $2.00. We sold 750 of them and in not a single package was there instructions as to how to turn the current on or off. It has been necessary for us to get those cards out ourselves.

The Chairman: Before opening the discussion I will entertain a motion for the appointment of a committee to bring in nominations for officers and also for the members of the executive committee of the Commercial Section.

Mr. J. R. Crouse, Cleveland: I move you that the Chairman be requested to appoint a committee to bring in nominations for the officers and executive committee of this Commercial Section.

(The motion was duly seconded and carried.)

DISCUSSION

Mr. P. S. Young, Newark, N. J.: Does Mr. Jones mean gross profits or profits which would be over all costs?

Mr. Scherck: I think the trouble with some of us is that we do not look in the looking glass. I am referring to this merchandizing-at-a-profit proposition and then price-cutting on certain days. I had heard about this Brooklyn scheme of selling stoves at half price. It seems to me it is a bad scheme. If this stove is worth $2.00 it is worth $2.00; if it is worth $4.00, it is worth $4.00. If my esteemed friend will allow me to say so, this cutting of prices is bad business. It is a good game, of course, for the Hot Point people. They proposed it to us, but we did not care to go into it. We handle other stoves, made by other companies. At one of the meetings of the Society for Electrical Development, a man who represents the president of the National Contractors' Association spoke before some of our central-station people on that point. He said, referring to a company in the East, "The trouble with you people is that you want to co-operate with us, you attend our meetings and do everything that is all right, as long as it benefits you. Your idea is to have us do everything that you want us to do." I would like to see a tendency away from that. I agree with the fundamental principle of this paper. We should sell goods at a profit. We can sell more at a profit than we can sell at cost. I had that illustrated recently in a washing-machine campaign. One of our agents thought we could sell a lot of machines by cutting prices and he cut from $90 to $60. We sold only three or four machines, and then the manufacturer said, "We will co-operate with you and sell this machine for $90." In the same territory, in one-fifth of the time, we sold 50 machines at $90. In the latter campaign we had the proper kind of salesmanship.

I think the idea of co-operation should prevail and we should bear in mind that to get the good will of the contractors, you have got to live up to it and play fair with them. It is not playing fair with them to cut prices or to adopt some of these new ideas. There may be times when there is a reason for cutting prices. We handle some gas appliances and as we intend to keep the whole shop force busy we announce that we have the organization and want to keep the men and because of this we cut the prices on piping old houses and on stoves. We have a good reason for it and that makes it right. We want to keep our organization intact.

MR. M. S. SEELMAN, JR., Brooklyn: I think Mr. Scherck's remarks indicate that he has a slight misconception and does not understand the conditions of this sale. That cut price was available to the contractors as well as to the central-station people, and the contractors could buy and sell that appliance for that single day for the same price as the central station. It was simply that the central station took advantage of the merchandizing opportunity and used it to the best advantage. Suppose you were running a shoe store or, in fact, any kind of store, and a manufacturer came to you and said, "Here is a pair of shoes which are to sell at $4.00, but for one day and for the purpose of introducing these goods, we will sell them at $2.00." You make up your mind that the shoe is worth $4.00. Now what kind of merchant would you be to say, "No, I won't take advantage of that." The very keynote of this Report is co-operation. We do co-operate in the best and most practical way with the contractors and supply houses, and the whole tenor of the Report is along the line which Mr. Scherck suggests. The trouble is that he has not grasped the spirit of the report.

MR. J. M. WAKEMAN, New York City: I would like to ask the exact meaning of the sentence on page 4, "Your Committee feels that it cannot too strongly recommend the sale of appliances by central stations." Do I understand that the Committee recommends that central stations go into the sale of appliances, or if they are in the business, that they maintain the proper prices?

MR. M. O. DELLPLAIN, Syracuse, N. Y.: I most heartily endorse the idea of the central station selling electrical appliances. If the appliances are good it is the duty of the central station to handle them and push them. If the appliances are not good it is the duty of the central station to find this out and let its customers know the facts. If there is any group in a community to whom the public should look for advice on electrical matters it is the central-station men. It is the business of the central station to popularize the use of appliances and the only way to do this is to handle them, not to the exclusion of the contractor or jobber, but by maintaining prices strictly and co-operating in every way possible with them. The trouble in the past has been that we have not been able to get contractors and jobbers to feel that the central station really wants to co-operate. There have been times when these men get the idea that we are willing to co-operate as long as we get our end of it, but the minute we stop getting our part we are ready to lie down. In other words, we start a campaign and sell five, six or seven thousand flatirons, then we stop and say, "We have the thing started, now let the contractor finsh it."

The contractors have not the organization that the central station has or should have. In the average city the central station certainly should have the organization to push things which a contractor or a jobber cannot be expected to have.

The tendency of our meetings, if I may be permitted to say so, has been to follow the large companies' way of doing things. Now, the large companies, when you get down to facts, do not need the Association. It is a good thing for them, of course, but they can get along without it, while the small central stations need this Association and the Association needs them. What is the percentage of small central-station members? The great majority of our members are from small central stations. Do we hear from them? Not very often. Who are on the committees? Members of the larger central stations, naturally enough, because they pick out the leading lights in the electrical field, but, I think, we ought to get away from these conditions. Let us put some of the little fellows on the committees. I know of no small station represented on the committee having charge of this Section. You cannot get results if you confine your activities to the large central station for it is not the one that needs it. Yesterday we had a discussion on the subject of advertising and the Committee was criticized for getting out certain leaflets. It is the best thing the Committee could have done because the small stations need just that kind of advertising matter. What we want is to get the small fellows interested and then not only this Section but this entire Association will boom.

MR. A. C. MCMICKEN, Portland, Ore.: Our company was one of the first on the Pacific Coast to take up the merchandizing of electrical appliances. We have tried it out in all kinds of ways for the last eight or nine years. We have tried most of the schemes advocated at this and at past Conventions. The statement made a few moments ago that the cutting of prices does not produce any material increase in business is, in my opinion, correct. I have, as a concrete example, a little experiment which I tried a few years ago in connection with flat irons. We became overstocked in a certain variety of iron. I thought by cutting the price on the iron we could sell it and get rid of it quickly. We reduced the price fifty cents but did not lower the price of the other two makes we were handling. Now the reverse of my expectation happened. People thought that because some irons cost more they must necessarily be better. In order to see whether this was due to the price or the name of the iron, I reversed matters and cut the other irons fifty cents, and the iron which was first cut sold best when the price was restored. Now this proved to me conclusively that the cutting of price on any article of that kind does not lead to larger sales. I think that we should maintain prices. Do not undersell the jobber or the contractor. I agree with the gentleman from Rochester that we have not yet got the co-operation of the contractors. They have no selling organization to reach the public and I think we can help them by maintaining prices.

THE CHAIRMAN: I am going to ask Mr. Jones to take the chair while I say a few words.

(Mr. Jones took the chair.)

MR. LLOYD: Your Executive Committee is and has been composed of members from the larger companies. We have tried for two years to get members from the smaller companies who would serve on the Committee. We have gone so far as to nominate smaller company members and elect them to the Committee, with the result that they did not attend the meetings. I want to say that if there are any managers present in this room who want to have their men broaden out and get the best out of the Association, we will endeavor to get their representatives on the necessary committees if they will let them come to the meetings. The unfortunate result of the two years' effort has been that committees could not get a quorum because company managers would not spend the money to send men to the central point selected for meeting. There has been no discrimination against the small company members. We want them. We are trying to do what is right. As this gentleman has so well stated, the larger companies can take care of themselves, but there is not a man on this Committee from these same large stations who is not on all subjects thinking of the best interests of the entire Association and has not the best interest of the Association at heart. We have not tried in any way to conduct the work for the particular benefit of the large station. We have tried to put the shoe on the other foot and we mean to try again next year.

Mr. C. P. Osborne, Spokane: In connection with what Mr. Lloyd has said I want to add that it is almost impossible for the small station men to go to a central point to attend these meetings. For instance, it would cost us $500 to send a man here from Spokane.

To go back to the Report, I am sorry that it does not go further into the problem of keeping busy. The selling of merchandize means nothing unless it is kept on the line. We do this in one way by making all of our ordinary repairs free. We repaired 8000 appliances last year free of charge, and it cost us about six cents a job. The elements are now guaranteed and there is no charge for repairs. The flat-iron itself, for instance, never gives out, and we are advocating the use of double cords, since the principal trouble is with the cords. If you conduct such a campaign it is a check on the manufacturers who sell poor appliances.

Mr. Douglass Burnett, Baltimore: I am very glad to find this discussion broadening out. I am glad because the principles Mr. Jones has put forward apply to all these various questions discussed. I had the pleasure of suggesting the formation of this Committee. My thought in doing so was that there was a lack of appreciation on the part of the large as well as the small companies of the possibilities of the work in this direction. Now I rather fear that the Report has been looked upon as referring to appliances. It refers not only to appliances but to all sales, and to the whole program of our work. I do not hesitate to say as strongly as I can that the new points brought out in this paper illustrate the importance of perfecting every detail of selling work. Now, that means a lot of things. It means not only that we need committees on the education of the salesmen, not only to educate our salesmen, but that we must have a representation of salesmen. It seems to me that next year we should have a committee on the needs of salesmen. The larger companies are represented here, the smaller companies are represented here, and the representative of the smaller companies perhaps feel that the Association is not doing enough work for them. They feel that more should be accomplished, and that the whole program should be broadened out, and to do this we should have representatives from the men on the firing line and the women behind the counter. We must carry this work to its conclusion. It is not enough that we have an office; we must have a salesroom and sales people. There are not one, or two, or three classes of salesmen and saleswomen, there are a dozen classes. We are inclined to think of outside solicitors as salesmen. Take the woman who is demonstrating from door to door. I venture to say that no one has discussed how this outside demonstration should be conducted.

There are many phases of this proposition. It is not enough that we should decide to maintain a fixed selling price. We must take local conditions and varying conditions into account. We found recently that a certain type of appliance had been superseded by a newer and better type. What could we do? Maintain the old appliance at its old price? No; we disposed of the old stock as quickly as we possibly could and for the best price we could get. It is entirely right that we should seek to maintain proper prices. Yesterday afternoon I went out with one of our men here to buy a certain article of clothing. We went into a store on Michigan avenue and the price named was ten dollars. My friend said, "It is worth only five or six dollars." We went to another place. A different variety of the same article was on sale at $10. We went to a third place. One of these articles was displayed for $13.50. It was the kind he wanted. He said, "I cannot afford to pay $13.50." I said, "Offer him $10. That is not a very common article, it is not called for every day and he may conclude to get rid of it." The deal was closed very quickly. Now that man maintained his $13.50 price. It was perfectly proper for him to sell that article at that time for $10 and he did not hesitate to cut the price. Why should we hesitate? We must have stores. Do not set them up as places to display goods but as places in which to sell them. Get in touch with the commercial end.

Our company recently made arrangements to take over a small plant. The day after we came into possession we went down to look at it. We found that any man about the place would cut a customer in—the lineman, the superintendent, or someone else. I said, "Are you sure you have got all accounts on the ledger?" The superintendent said, "Yes, but I'm not sure that all meters are carded." We went into the store and we found the paint coming off the window. The woodwork on one end of the window was actually disintegrated. In the window were appliances covered with dust, without any price on them, and without any evidence of having been handled since they were placed there. Among them was an advertisement of a lawn-fête which had been held three weeks before. These appliances lay on a white cloth streaked and dirty from the rains.

I asked for the stock of appliances and found they were in the window. Now just suppose that they sold one of those appliances and it proved to be defective. The customer would, of course, bring it back. Anyone knows what will be said. "We will send it to the manufacturer and have it repaired." "Who is the manufacturer?" "We will have to find out." Would it not be absurd? I asked for the lamps and they took me back to a cupboard in one corner where they were piled up indiscriminately in a heap.

Now the first thing we did was to find the real estate agent to inquire about the lease. It had expired two years before. (Laughter.) We all know of just such places.

We are not going as far as we should on this matter of accommodation. When a person brings in a defective iron to us we call for the "fix it" man, and we keep the customer there showing him something while the repair is being made. The matter of maintenance takes its own place. Our problem is to study the needs of our customers, and how to handle transactions with the customers in a straightforward and business-like manner. We need all the short-cuts we can get. Don't cut them out. Suppose a woman telephones in and says, "I have taken such and such a house and I want service to-morrow." Why fuss with an application? Why not give her the service? (Applause.)

I hope you will pardon me for speaking so frankly, but I like to look at business in a business-like way. The man that bought the $13.50 article for $10 did not make us write out an application blank. There are companies in this Association who do not even ask a deposit from some of their customers. Others insist on it always. In Baltimore we are busy giving back deposits. We cannot keep up with the necessity of giving back deposits. Now that does not mean that we do not know the standing of our customers; what we do know is where to ask for deposits. Our worthless bills are a fraction of one per cent; 99 2/3 per cent of our bills are paid. We cannot afford to tangle up our relations with customers by asking useless questions. We recently had a joint meeting of our gas and electric men. There were several questions brought out. One was, "Are we not asking too many questions of our customers?" One of the men read a list of the questions which even went so far as to cover the point of marriage. A young woman who comes in to buy a gas range is asked whether she is married or not; if married her husband's full name, and where he works. (Laughter.) If she is not married he has to find out who her husband is to be and write down on the application "wife to be of John Jones." This was a gas man, not an electric man. An electric salesman said, "We ask the full name, the address, the installation, where the service was used before, and other similar detail." I tell you we must look at these questions from the commercial point of view.

We, in the big companies, need help as much as the little companies. I have been a member of the Committee on the Organization of the Industry and have very little to show myself in the way of new members. Why? Because I cannot get the attention and help of the small companies. They come back with the statement, "We cannot afford to have a commercial department. We all take care of our business." They do not appreciate the necessity of handling these matters in a business-like way. You have caught the drift of my remarks, gentlemen, and it is this: All Mr. Jones is trying to tell you is, "Attend to your business in an ordinary, every-day, over-the-counter way, and forget that you are central-station men."

Mr. Jones: In answer to Mr. Young I will say that the profit mentioned is a profit over what the total cost figure is; to the cost of the appliance, add the other items that go to make the cost to you, such as rent, labor, delivery, etc., and then, as a profit, add 33 1/3 per cent.

I will say, as Chairman of the Committee, that the majority of the members feel that every central station should sell appliances at a profit to itself. Every person you can get to sell appliances pushes the game along, for every appliance sold means just so much more business. It is absolutely fallacious to think that the sale of appliances belongs only to jobbers and contractors.

Now as to the $2.00 Hot Point campaign. It was excellent business. I got the contractors of Brooklyn together and told them what I was going to do, and that I wanted them to tell me what they thought about it. With the understanding that the goods were to be sold to us at half-price, I said, "If there is anyone among you that wants to sell also, we will give you the appliance at the cost price to us plus five per cent for handling." They had the same opportunity as we had, and if you say that is not good merchandizing, I must disagree.

Mr. Scherck: How did you get the same percentage unless the discount varied.

Mr. Jones: We got 33 1/3 per cent profit on that appliance if we sold it at $2.00, above the cost, the same as if we sold it at $4.00.

Mr. Scherck: My point is this: The central station benefits by the sale of current and the comments which I hear lead me me to believe that while your percentage might have been the same, the amount of profit was such that, without the advantage of selling current the contractor could not afford to sell at the campaign price. A second point is that other manufacturers are selling stoves at legitimate prices, and contractors carry these in stock, and my experience with the older manufacturers is that they did not do that.

Mr. Jones: What has the amount of profit got to do with your basis of profit? I stated that we should sell our goods at 33 1/3 per cent profit over gross cost. The *amount* of profit necessarily varies with every article sold.

Now, in regard to keeping the appliances busy. We not only sold these $2.00 appliances, but after they were sold sent a demonstrator out to see whether they worked, to give instructions in turning the current on and off and to inquire if they had given absolute satisfaction. Nine out of the first sixteen reports were that the appliances had given such satisfaction that the demonstrator sold more appliances right on the spot. To state that you cannot get satisfaction out of a sale of that kind is to say that the principal merchandizing idea of the great department stores of the country is wrong. To sell merchandise successfully you must adopt merchandizing methods.

THE CHAIRMAN: The next report is that of the Advertising Committee, Mr. J. R. Crouse, of Cleveland, Chairman.

MR. J. R. CROUSE, Cleveland, O.: Mr. Chairman and gentlemen: I want to say that I had nothing more to do with this Report than to criticize it. My confrères prepared the paper and I shall ask them to help me in defending it.

REPORT OF THE COMMITTEE ON ADVERTISING

Why, when, where and how a small central station should advertise is the important subject that has been thoroughly studied by your Committee on Advertising. In considering this subject, the Committee has departed from the reports on advertising read before the National Electric Light Association at previous conventions, and has made definite and specific recommendations designed to guide a Commercial Department in planning its advertising.

The small central station we are addressing is the station in towns of less than 100,000 population. Every central station, regardless of its size, must advertise if it would grow to the fullest extent. Even in the town of 1000 population, where the manager calls everyone by his first name, advertising will help to sell on the days the manager cannot see each one personally; and then too the salesman's time is too valuable to be spent in doing anything that can be accomplished by advertising. It should always be borne in mind that the best advertisement a central station or any other commercial organization can have is a satisfied customer, and every activity of the central station that will make for satisfied customers is an advertising investment of greatest value. By advertising, 40 per cent of the arguments advanced personally by the salesman or manager can be said and said better. Fully one-half of the calls of a salesman can be eliminated by proper advertising and perhaps one-fourth of the sales credited to the personal efforts of representatives could be secured more cheaply and just as well by the printed message.

Of course, much depends upon the message—what it is, where and when it is given. There are many kinds of advertising—mostly bad, none perfect. Good advertising is one of the best, one of the most effective means of "making the people want the goods." Electric service and electrical merchandising are a specialty. They can hardly be considered an absolute necessity in the home. Being a specialty it can scarcely be expected that advertising alone will do the selling. The actual closing of the sales can seldom be done by advertising; it must be done by personal solicitation.

Who Should be Responsible for the Advertising in a Small Central Station—What Individual?

Every plant cannot afford an advertising department; the majority cannot, but there should be appointed some one individual in every station—one man who is to have charge of and be responsible for the advertising. He need not necessarily devote all of his time to it, but it should be conducted on a serious business-like basis. If the authority and the responsibility are delegated, the advertising will show results.

At the present time fewer than 50 per cent of the central-station companies are designating this one person to have complete charge of the advertising. Scarcely 20 per cent of the stations interviewed were giving to their advertising anything like the serious consideration they should give. In each of the stations comprising the virtuous one-fifth the advertising was given a clean bill for producing profitable results. Many stations are designating an enterprising solicitor to handle this work under the manager; in other places the store manager is also the advertising man. We find no record of stations in towns of less than 50,000 where there are advertising men devoting all their time to advertising alone.

The advertising man should be of the same general type as a manager. His literary abilities while valuable are perhaps the least important of his qualifications. He should, next to the manager, be the progressive element, the promoter, the "live wire" in the affairs of the company and in the community. Tactful and diplomatic he must be to prove efficient in dealing with the press and the public through the press. It has been customary to consider the advertising as an activity of minor importance not requiring serious thought, but such a feeling should be dispelled; advertising and selling are equally as important to the earnings of the central station as engineering and operation. The relation between the advertising and the selling should be one of most intimate co-operation and mutuality. Rather than have anything but closest co-operation between these two departments, it would be better to discontinue either or both. Without the closest co-operation they cannot produce business. They should synchronize and together pull the load that produces more than a normal increase in business.

How Much Shall be Spent on Advertising?

There are two right ways of making an advertising appropriation—there are many wrong ways, which need no mention. Any way is wrong that does not permit of planning at least six months in advance. The two right ways of making an advertising appropriation are these:

(1) Appropriate a certain percentage of the sales of the previous year

(2) Appropriate a certain amount for each unit of energy or merchandise it is planned to sell

Of the two methods the first seems to be the more businesslike and is conservative and entirely rational. We recommend this system. The second system has, however, been successful and may often be used.

The usual appropriation is from 1 to 5 per cent of the gross receipts. Many of the smaller stations spend as high as 5 per cent on advertising, while 1½ per cent for a certain large syndicate is found to be sufficient. Of this 1½ per cent, 1 per cent is devoted to newspaper advertising.

The appropriation should be considered as an investment not an expense. If this money be placed at the disposal of a live, well-counseled advertising man, and proper sales co-operation be given, the returns will in general be greater than from other investments, but of course it cannot rightfully be expected to get 100 per cent return in a single year. A single campaign in a single year will not usually pay for itself, but like any other good investment the earnings will be worth while from the start.

WHERE SHALL THE APPROPRIATION BE SPENT—THE MEDIUMS?

Newspapers

Without reservation we recommend newspaper advertising. No station can afford to spend less than a large share, at least 50 per cent of the advertising appropriation, in the local papers. They are the important medium. Everybody reads the newspapers, and the smaller the community the more carefully are they read. Aside from the inherent advertising value of the local papers, space in them should be used to demonstrate the spirit of co-operation which should obtain among all local interests, making for the common up-building of the community. The newspaper is a force for progress and growth, just as the central station is such a force.

How to Select Newspapers

All the local newspapers should probably be used to some extent to maintain their good will; but the station should be guided in spending an advertising appropriation by the advertising value received. A certain well-known manufacturer carries an account on the books of the advertising department called Policy and Co-operative Advertising, which is separate from General Advertising, and to which are charged expensive items which are less in the nature of advertising than of co-operative support for worthy and valuable activities. Perhaps such a division of expense would help many central stations to determine if their advertising is really profitable.

Here are 12 items to consider in judging of newspapers:

(1) Favorite department-store medium
(2) Favorite for want advertisements
(3) Whether claimed or certified circulation
(4) Selected by foreign advertisers who use only one paper
(5) Volume of fraudulent or questionable advertising carried
(6) Comparative amounts of all advertising carried
(7) Morning, appealing to the better class
(8) Evening, appealing to the masses
(9) Politically on winning side
(10) Percentage circulation within city limits
(11) Run-of-press rates and rates for preferred position
(12) News co-operation

Each of these items is merely a guide to the proper purchasing of publicity power; one should never buy just space but rather buy an audience. The worthy papers prove themselves when these questions are asked of them.

Morning Papers

Considering the comparative worth of newspapers as advertising mediums the advocates for morning papers base their claims on the following:

(1) Every man in any household of standing in a commercial, professional or political way in the community picks up his paper at the first leisure moment in the morning. This is a fact so well known that it is a common subject for jokes. You need to look about well among your friends of means and consequence to find a man who does not either at home or on the way to the office read the morning paper. This being the case, the morning paper to be successful must appeal, as it does, to the better class of people.

(2) The policy of the morning paper is always to build up, not to tear down.

(3) No good morning paper runs scare head-lines and unreadable stories concerning scandals, crimes, etc.

The central station will find the morning paper particularly adapted to the advertising of commercial applications for electricity and will find its advertising of considerable value in maintaining the good will of the community. If the central station retains the good will of the influential classes the masses are likely to follow. The morning papers in large cities are probably more influential than in the smaller cities, and in the very small towns morning papers are not published.

Evening Papers

The following facts concerning evening papers should be considered:

(1) Reach the masses and have a larger circulation than morning papers
(2) Where the carrier system prevails evening papers are more thoroughly read in the home than morning papers
(3) Women read evening papers more than morning papers
(4) The papers are less carefully made up, being necessarily hurried
(5) Contain less fresh news and much re-hashing of news from the morning papers
(6) Have more features, such as funny cartoons, colored headlines and sensations
(7) Politically, evening papers represent the common people and are more independent than morning papers.

(8) Because of the greater volume of advertising in the evening papers, it is to the advantage of advertisers to purchase preferred space. In the morning papers preferred space is often given at regular rates.

Policy advertising, advertising for the wiring of existing buildings, and advertising done to increase the use of electric light and the better known electrical devices, such as flat-irons, vacuum cleaners, etc., can be done more efficiently in the evening papers than in the morning papers. Special campaigns for the introduction of cooking devices, Christmas campaigns and the selling of electrical Christmas presents should be concentrated in the evening and Sunday papers.

Sunday Papers

In balancing the Sunday papers against the daily papers the smaller central station should consider the following points:

(1) Rate per line per thousand of circulation averages about 30 per cent less than in the morning papers and 20 per cent less than in the evening papers
(2) The readers of the Sunday paper have leisure to go over all of the pages and read advertisements as well as the text matter
(3) The Sunday paper goes to the home
(4) Important advertisers always use Sunday morning papers for announcements
(5) The Sunday papers are anxious to print stories regarding electricity and its applications; also to show up developments in the local central-station plant
(6) The Sunday papers will provide a preferred space at regular rates
(7) The Sunday papers have a widely distributed circulation and the central station will probably purchase considerable audience in the Sunday papers not reached by its lines
(8) In the smaller cities the Sunday morning circulation is monopolized by foreign papers, which are not to be used for local central-station work.

For properly advertising electrical devices for the home, for the advertising of new and old house wiring, for policy and for "present" day advertising the Sunday papers should be used by the central station in its regular advertising. They are also properly used for making important announcements.

Electric Signs

No central station can hope to sell many electric signs if it does not use them itself, and aside from the ethics of the case, no better and cheaper advertising can be done. The central-station sign should set the "sign standard" for the city, and, of course, the higher the standard the more sign load can be connected. Next to newspaper advertising the electric sign is of greatest importance.

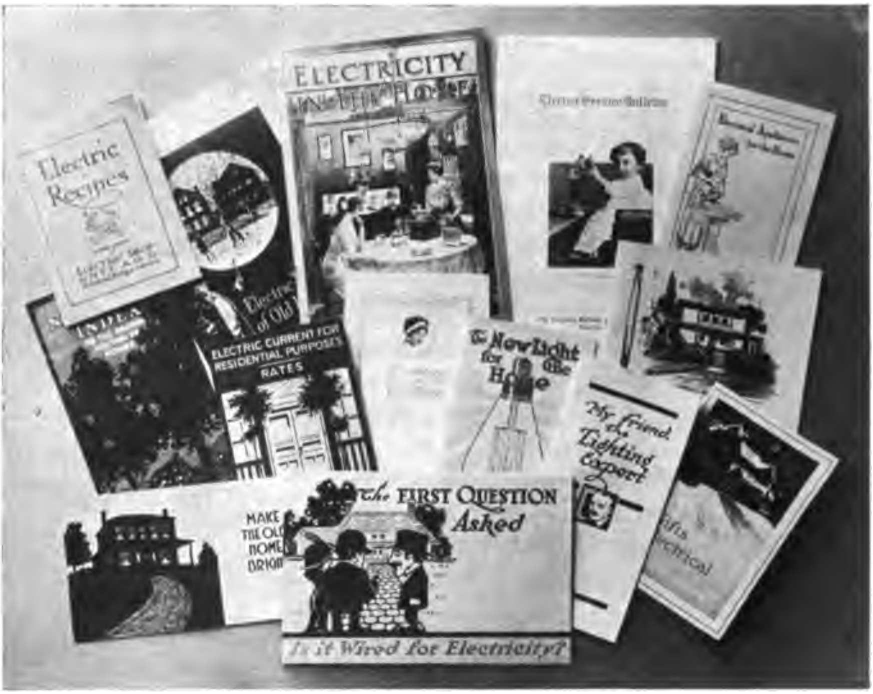

Electric Recipes
ELECTRICITY IN THE HOME
Electric Current for Residential Purposes
Rates
The New Light for the Home
My Friend the Lighting Expert
Make the Old Home Bright
The First Question Asked
Is it Wired for Electricity?

FIG. 1. DIRECT MAIL LITERATURE WILL CARRY A CONVINCING STORY TO KNOWN PROSPECTS WITH MAXIMUM ECONOMY

Mails

A medium of almost equal importance to newspaper advertising is the mail. It has been stated that if a department store knew exactly who its customers are, it would probably do very little advertising; that is, if it could with a reasonable degree of certainty select from the population of a city 1000 men who need new hats or new shoes at a certain time, it would probably address these men by mail rather than through the newspapers. The central station knows its prospective customers, knows that those tenants whose houses are wired are prospects for electric irons, toasters, grills, vacuum cleaners, etc. It knows that those with houses unwired are prospective customers for electric service. In specific campaigns the central station will find that direct mail advertising will produce greater immediate results per dollar of expenditure than any other form of advertising. Mail advertising should be so planned as to produce inquiries.

The one strong feature about mail advertising is the fact that a very select audience can be obtained and an exclusive personal message can be carried to this audience. In a town of 100,000 population a newspaper has ordinarily an average circulation of 20,000. An ordinary letter would occupy 50 inches of space and at an average rate of 40 cents an inch would cost $20. The postage for addressing every wired house in such a town would amount to about $20, and the total expense per mailing would be less than $60. One cent postage will carry a weighty and valuable argument to a prospective customer. Just consider how far an $80 salesman can go for one cent and how long he can talk for that small amount. Such a man costs just about one cent per minute. The mails carry your exclusive message promptly. In campaign work the mails are vital to success. The monthly bills, if delivered by mail, should always contain some message for improving or extending the service. House organs are a common and successful medium of mail advertising. An average expenditure for mail work might be 25 per cent of the appropriation.

Window Displays

Display windows will be well used, (1) because they are excellent advertising—they display the goods themselves and demonstrate them, and (2) because the central station should set the pace in any city for good window lighting and display. The standard of illumination in a community may be raised by a single window, well lighted. Good window displays take time in planning and installing, but aside from that cost little. Whatever it may cost to get motion and light in a window, the money is well spent.

Shows, Demonstrations, Fairs, etc.

These general mediums are always profitably used and fostered. Electrical shows in the larger cities have lost some favor by continued use, but in most small places they are considered an event and well patronized. No town is too small for such a show. A city of 20,000 held a very successful show recently. Demonstrations in the salesrooms grow ever more and more popular. Local fairs are always patronized by the central station, not only for their advertising, but for their good-will value. Local pride is fostered by such events as these. The central station cannot be too public spirited, and local events offer an excellent opportunity to show this spirit.

Theater Program and Scheme Advertising

Business men are constantly besieged by promoters of scheme advertising. The most insidious of all these is the program vender—the church, the lodge and other institutions look upon the program as a means to get money and upon the business man as the person to be exploited. Such publications are of absolutely no value from an advertising point—no one reads them with serious consideration. Even if they are kept they are never read again but are rather reminders of the event. This applies to circus advertising, race meet programs, fair programs and baseball score cards and programs. If it seems necessary to help worthy causes in this way, first be sure that the program rights have not been sold out to a third party and then charge the expense to charity or to policy advertising.

The only possible exception to this is theater program advertising. The theater has its patrons who go in a receptive mood. Between the acts they either chat or read the programs. For the advertising of electric automobiles and household cooking and heating devices, the theater program is a good medium, especially in the larger cities.

Miscellaneous

Picture show advertising will be found valuable and inexpensive. Street car advertising is an excellent medium of publicity, inasmuch as the circulation will be confined entirely to districts coming under the central-station lines. Street car advertising might truthfully be termed "class" advertising for a central station, it follows so closely the lines of the service. The expense of car advertising is not great. The space on the front of street cars, 24 in. by 20 in., is usually reserved by the traction company and in the case of a combined central station and street railway company, this space should always be used to advertise electric service.

Billboard advertising is undoubtedly valuable, although how valuable is still much of a question. In the larger cities it has attracted considerable attention. In general, however, it is open to objection in that it does not permit of educational copy and the extension of the use of electricity in its many adaptations depends primarily upon educational work. People will use more electrical energy when they understand its possibilities. Billboard advertising is more adaptable to publicity, and one word or thought or picture is hardly enough to convert the average public to the use of electric service. To illustrate this further, can the average man tell you how many buttons he has on his coat sleeve, and what particular kind of button they are? Most men and women see many things every day that they do not notice carefully. Few of us can recall the brands of tires, foods or clothing that are advertised. Our recommendation to the average small central station is, do not use the billboards as a general medium. Be careful of "eye-deep" advertising. It has not the effect of making the people want the goods.

In discussing mediums we have not attempted to state exactly how much should be spent on each. After determining the total appropriation, it is necessary to decide this in turn. Where the central station is carrying on an intensive advertising campaign, as, for instance, a campaign for house wiring or for the sale of electric irons, diversified advertising, *i. e.,* the use of every available medium, will bring sure and quick results. It is better not to use a medium unless it can be well used. One-time or sporadic advertising is the cause of many advertising failures. It is better to give the medium a good chance to make good or to leave it alone until another appropriation is made.

COPY

The first requisite in any advertising copy is an idea. The advertisement with the best idea back of it is usually the one to bring results. Copy without a good strong idea is "spineless"; it cannot have the "punch" which will bring the public to action. What is really desired from any advertisement is favorable action, so test every piece of copy for the worth of its predominating idea. Beware of too many ideas; one, if it be a good one, is sufficient. Limit practically every advertisement to one idea. It is always well to limit the idea to one product; for instance, it is seldom found profitable to advertise cooking devices. An advertisement, on the contrary, which deals exclusively with electric toasters, electric chafing dishes, electric percolators or an electric grill, will be much more successful.

How Long Should an Advertisement Be?

We are inclined to answer as Lincoln did when asked, "How long should a man's legs be?" His reply was, "Long enough to reach to the ground." That explains exactly how long an advertisement should be—long enough to convince. Better long than too short, for if a man's attention and interest are once obtained, he should be convinced of the point considered in the advertisement. He is the man who is most likely to buy; he is exactly the man who must be convinced. Those who cannot be interested are not prospects; they must be convinced to become buyers.

Comparative Value of Copy and Space

In the offices of a well-known advertising agency is this motto: "It is better to put $50 copy in $5 space, than $5 copy in $50 space." Never hesitate to spend time and money to make the copy right; the best copy is best worth using.

Your salesmen cannot persuade a man to wire his house or to install an electric sign in two minutes, even when he has undivided attention. If a house-wiring contract is made by the average man, something other than your representative's talk helped to persuade him. We believe it well to use copy which will help to persuade—"will help to make the people want the goods."

Importance of the Right Kind of Copy

A salesman, because he gets into the presence of a buyer, states that he represents a company, and asks for an order, does not establish himself as a salesman. Words displayed in type in a publication that goes to a prospective buyer do not necessarily make an advertisement. Salesmen are judged as salesmen only by the sales they make; an advertisement is judged by the interest it creates. The medium is the "wheel-barrow" which conveys the copy into the presence of the people to whom we wish to talk. The copy in an advertisement is as important as the words a salesman uses. The salesman has an advantage because of his personality. He uses facial expression, and the intonations, inflections and accents of speech. A slight change in tone or expression changes the meaning of some words entirely, but with printed sales-talk all this is lacking, so that words and phrases must be carefully selected. The number of men who can prepare copy which will be both educational and convincing are few. That a man can write is no reason for expecting him to be able to prepare convincing copy that will sell apparatus or energy. The successful copy writer must have native ability and must be schooled and trained by experience.

Good copy is being produced every day. It is doubtful, however, whether the cleverest pen will always produce copy with the "punch" in it. Some pieces of copy are always more successful than others. This suggests the exchange of advertising copy between member companies. Copy that is successful in one place under local conditions is not always successful when transplanted, but a good idea usually remains good everywhere, and the copy can easily be adapted to local conditions. Advertising men in the member companies should freely exchange copy, as such exchange will add to the efficiency of their department. One medium of exchange has already been worked out through the manufacturers, who supply reprints of successful copy to any central station interested. The Society for Electrical Development will, when completely organized, be of great help to central-station advertising men, through a co-operative bureau which it means to establish.

Changing Advertising Copy

No hard and fast rule can be made for changing copy. In general, it is well to change copy very often, repeating an advertisement a few times only. The comments, inquiries and sales made will be a criterion for judgment. Occasionally an advertisement will meet with extraordinary success. When such is the case, use it until it loses its "pulling power." Often a few slight changes in these successful advertisements will prolong their usefulness. The theorizing writers on advertising subjects will disagree as to this, but, after, all sales settle the question and are to be considered. Returns count, hence we recommend that an advertisement be used as often as it brings returns. A word of caution should be added to this, however. Judge every advertisement carefully and unless it be really good change it after it has appeared once.

How Often to Advertise

The central station should advertise continuously because there are always prospective customers for service. Unlike any other business there are no slack seasons for the wide-awake central station. There are always special services to advertise. It is well to make copy to suit the season. The following list shows what to advertise in season:

January, February	Policy of the company Uses of electric service
March, April, May	Domestic— Electric vehicles House wiring Vacuum cleaners Electric irons Renewing of lamps Household power devices Commercial— Power applications Window lighting Street lighting
June, July, August	Domestic— Electric vehicles Electric fans Electric cooking devices Electric irons Porch lighting Commercial— Electric signs

September, October	Domestic— Electric lighting House wiring Commercial— Store service Industrial service Electric trucks Policy of the company
November, December	Domestic— Electrical Christmas presents Electrical heating devices Commercial— Electric delivery trucks

It is much easier to reach a prospect at the time he is interested. By making the advertisement seasonable it is possible to reach interested people with a convincing appeal. Some background work is always necessary to consistent advertising. Annual effort at the beginning of the year to impress the public with the fair and broad policy of the company will be effective in creating good will. The desire for electrical service will be popularized by strong "Do it Electrically" copy, shown before the special spring campaign work is started.

SPECIAL CAMPAIGNS

The old adage about "aiming at the stars" is but partly true as applied to central-station advertising. Rather we must aim at a star and concentrate every effort to accomplish a desired end. It is general practise in planning advertising and selling campaigns to divide the principal campaign into smaller sub-campaigns, each intended to accomplish a definite result. The big accomplishments in the industry were made possible through particularizing and specializing for a given length of time. House wiring and electric iron campaigns have been very common in many companies. Special offers lasting for a short period of time bring action from the public; and like sheep, one person will follow his neighbor so that the first action really amounts to double in the final results. Department stores created this method of stimulating business. While we do not recommend that all the methods of the department store be followed, we do believe that certain of them may be studied and adapted to central-station business with profit. Special campaigns are useful if only as pace-makers for the new business department.

House Wiring Campaigns

From the experience reported by many member companies it is known that the most successful scheme for advertising house wiring is based on a special rate or inducement offered in the form of an instalment plan. The majority of central stations making a determined effort to wire old houses offer some concessions. A few of these propositions are here listed.

(1) Homes wired at cost, including fixtures, glassware and lamps, allowing 10 months to pay for installation. The cost is billed with the regular monthly invoice of the consumer.

(2) Homes wired at a pre-determined flat rate, depending upon the number of sockets, switches, etc., and upon the type of house construction. The payments are made on the installment plan, 10 months to 2 years being allowed for payment. The flat-rate wiring schedule used in Cleveland, Ohio, is as follows:

PRICE LIST OF OUTLETS AND HARDWARE

GENERAL

All openings for switches, receptacles, drop cords and fixtures are considered as outlets and based on a unit price for houses of different classes of construction.

The cost of switches, receptacles and drop cords should be added to the price of outlets, and this sum will be the contract price for all labor and material necessary to complete the work as outlined in the schedule.

All extra outlets, switches, receptacles and drop cords will be charged for at the rates accorded to the class of house for which the contract is written.

OUTLETS

No. of Outlets	Class A Single Flooring	No. of Outlets	Class A Single Flooring
5	$15.85	33	$58.05
6	17.85	34	59.45
7	19.85	35	60.85
8	21.85	36	62.25
9	23.85	37	63.65
10	25.85	38	65.05
11	27.25	39	66.69
12	28.65	40	68.33
13	30.05	41	69.97
14	31.45	42	71.61
15	32.85	43	73.25
16	34.25	44	74.89
17	35.65	45	76.53
18	37.05	46	78.17
19	38.45	47	79.81
20	39.85	48	81.45
21	41.25	49	83.09
22	42.65	50	84.73
23	44.05	51	86.37
24	45.45	52	88.01
25	46.85	53	89.65
26	48.25	54	91.29
27	49.65	55	92.93
28	51.05	56	94.57
29	52.45	57	96.21
30	53.85	58	97.85
31	55.25	59	99.49
32	56.65	60	101.13

CLASS B—MIXED FLOORING

PRICES AS PER CLASS A, EXCEPT AS BELOW

Placed under double flooring, second or third story

Ceiling outlet	$1.00 extra
Switch outlet (controlling any center outlet)	1.00 extra

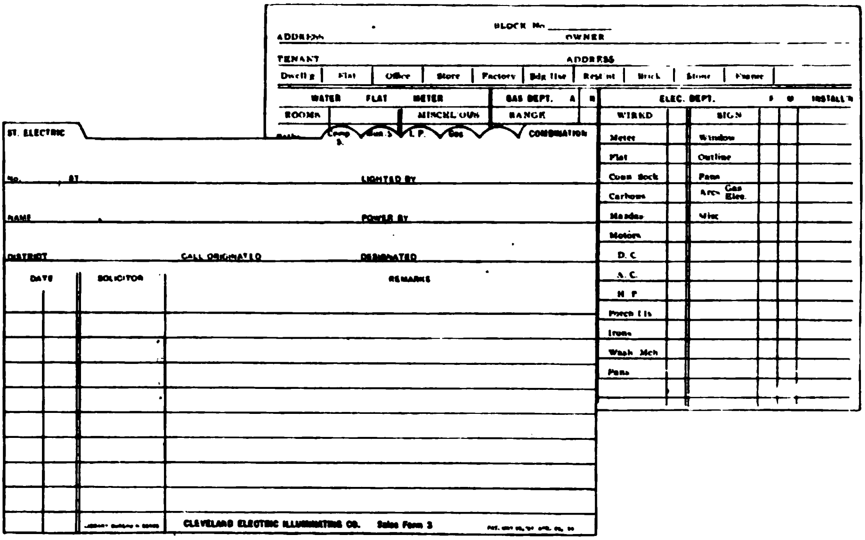
Placed under hardwood flooring, second or third story

Ceiling outlet	$3.00 extra
One switch outlet (controlling any center outlet)	3.00 extra
Additional switch outlets on same gang (controlling same center outlet), each	1.50 extra

HARDWARE

Push-button switches	$1.25
Push button, 3-way switches, per set of two switches	3.50
Push button, 4-way switch	2.45
Three-way snap switches, per pair	1.95
Porcelain base switches, each	.30
Porcelain base Edison receptacles, each	.30
Bryant flush plate receptacles	.80
Chapman flush plate receptacles, each	1.15
Drop cord key sockets, each	.35
Drop cord chain sockets, each	.50

The great advantage of the flat-rate schedule is that it enables the solicitor to give the prospect the price of the work at once without having to measure and calculate. While the prospect is interested the solicitor can get the order. Several stations have found this scheme practical; in Cleveland more than 1800 old houses were wired last year. The schedule given allows the contractor a reasonable profit on the work.



BLOCK No.

ADDRESS OWNER

TENANT ADDRESS

Dwell'g | Flat | Office | Store | Factory | Bdg Use | Brick | Stone | Frame

WATER FLAT METER | GAS DEPT. A B | ELEC. DEPT. INSTALL'N

ROOMS | MISCEL'OUS | RANGE | WIRED | SIGN

Comp. S. | L. P. | Gas | COMBINATION

Meter | Window

Flat | Outline

Conn Sock | Fans

Carbons | Arcs Gas Elec.

Mazdas | Misc.

Motors

D. C

A. C

H P

Porch Lts

Irons

Wash Mch

Fans

ST. ELECTRIC

No. ST. LIGHTED BY

NAME POWER BY

DISTRICT CALL ORIGINATED DESIGNATED

DATE | SOLICITOR | REMARKS

CLEVELAND ELECTRIC ILLUMINATING CO. Sales Form 3

Fig. 2. Cards for Compiling Prospect Lists for New-Business Campaigns

(3) Homes wired at contractors' rates and a premium or cash discount, or free use of service for four months allowed as a special inducement. Lighting fixtures, flat-irons or toasters are the usual premiums offered.

With some inducement offered, the campaign for house wiring usually consists of newspaper advertising, direct-by-mail advertising, personal solicitation, window displays, store demonstrations, and such other miscellaneous activities as may be devised. The newspaper advertising usually states the special inducement which is limited in time in order to produce immediate action. The lists for direct-by-mail advertising are best obtained from a personal canvass made of all the residences in the city. This canvass may be expensive to obtain, but successful central-station operators state that it is absolutely essential to the most efficient new-business work. Two forms of card used in making this canvass are here reproduced. (Fig. 2.)

In addition the illuminating company gives a bonus to the contractor of 10 per cent of the contract price; not less than $5, nor more than $10, which amount is to cover the selling expense.

From this or a similar form the actual prospects for any service may be found at a glance. Knowing just who are prospects is exceedingly valuable information. An excellent mailing list may be made up by requiring each solicitor to turn in 15 names per day. If there are five solicitors, this will bring in a total of 75 names a day or approximately 2000 names per month. To secure 15 names will require less than an hour of the solicitor's time. While there are other ways of obtaining a mailing list, we believe it is highly desirable to have an actual check on each prospect through a personal canvass.

A comparatively new idea for indicating graphically the prospects for house wiring, electric irons, cooking devices, etc., is to obtain from the city tax department or from insurance companies, a large plat of the city. Large cities will consist of several sheets and the small cities of but one or two. On this plat can be indicated every residence in the city; each residence can show by means of pins or tags of different colors, whether it is wired and what electrical devices it contains. If the city is divided among several district managers, inspectors or solicitors, one can tell at a glance just which district is forging ahead and which is slow to respond, and the advertising can be shifted to bring all districts up to the happy level.

Another way to compile a mailing list for house wiring is to consult the water and tax records, comparing these with the list of central-station customers. The tax reports will give the owners of the property and the water records will usually give the tenant. It is very necessary to a well-planned campaign to have the lists divided into (1) names of home owners; (2) names of landlords and (3) names of tenants. With the first division every argument for electric service can be used; with the second, such arguments as increasing the rental and selling value, pleasing the tenants, decreasing the fire risk and the cost of up-keep of decorations; with the third, convenience, economy, healthfulness, beauty and safety. The direct-by-mail advertising should consist of form letters with suitable enclosures. The letters should be carefully duplicated, but not necessarily "headed in" above the salutation. Experiments carried on to determine the relative efficiency of typewritten and duplicated letters showed almost equal efficiency. Few form letters are sent to the home and a good letter is almost sure to receive attention. Third-class mail addressed to the home gets practically the same attention as the same letter sealed and sent first class.

In these form letters one predominating idea is enough in each letter. Enclosures are used to enforce this idea and "drive it home." One is apt to believe what he sees in print, therefore prove the arguments made in the letter with printed statements. The number of mailings in a house-wiring campaign should not be less than four. Six mailings are often found more efficient, but it is seldom that fewer than four mailings will disclose the live prospects.

Every mailing in a campaign should be designed to get inquiries. Enclosing self-addressed postal cards makes it easy for the prospect to take action. An inquiry is a gem to be prized and cared for. Every legitimate inquiry should produce business, as it gives the salesman or solicitor the name and address of an interested person—one who is ready to buy. Inquiries should be turned over to the sales force immediately. No time should be lost in following up the inquiry; allow no time for the interest to cease or cool down.

Some central stations have carried on vigorous advertising campaigns, but have neglected personal solicitation. This is, of course, not an efficient way to produce business. In order to get the most from an advertising campaign, every prospect should receive a personal call from a solicitor.

Picture Show Screens

Picture show screens are good mediums as house-wiring advertisements. Slides illustrating the ease of wiring and the convenience of electric service are easily obtained locally or through manufacturers. Motion pictures having this same theme are also available at the manufacturers. Rental signs like the one here illustrated help the campaign by making it almost impossible to rent unwired houses. Liner advertisements carried in the

"Wanted" section of the newspapers, listing the wired houses that are for rent under the caption "Electrically Lighted Houses," will create good will among landlords because of the free advertising. This need be done only twice a year to get the desired effect. During the campaign, the street car space can well be devoted to house wiring. Nothing helps to boost like the display windows. Prove the value and economy of electric light in them.

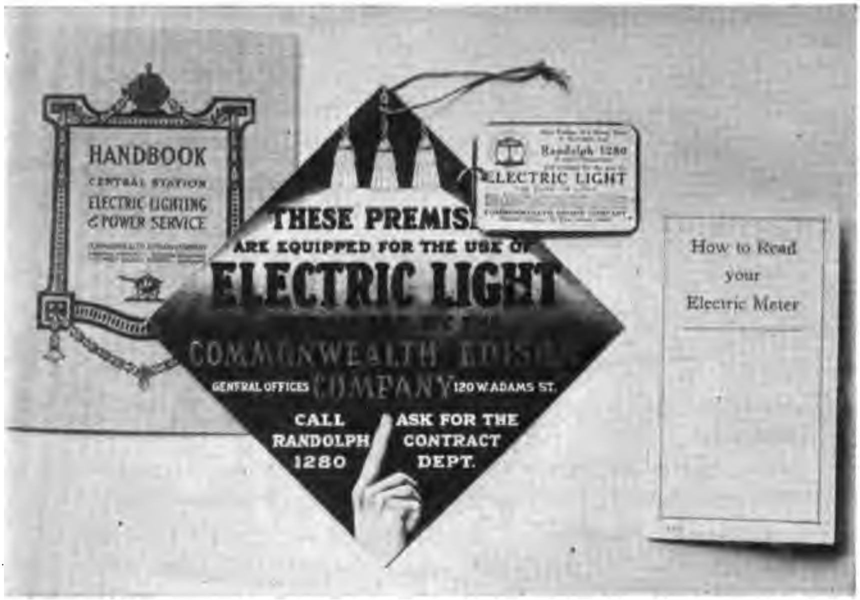


Fig. 3. Central-Station Literature. The Square Card is Hung on the Fixture by the Meterman. The Small Tag is Attached to Keys by Rental Agents

The average cost for securing residence customers in unwired houses is $4.00. This is a general average of about 15 stations.

Campaign—Houses Wired but not Using

Every station thus far interviewed has admitted having some houses on its lines which were wired but not connected for service. The number of such homes where figures were available varied from 7 to 13 per cent of the total number of homes connected. To reach these homes, a simple campaign only is necessary. Two letters have "turned the trick" and secured the prospects by showing them the economy and convenience of the service. This condition exists often because of neglect to interview the tenant shortly after he moves into the premises. A postal card tied to a fixture of the vacant house at the time the meter is disconnected will make it easy for the new tenant to notify the central station to re-connect the meter. These cards may be printed forms, ready for the signature of the tenant.

Heating and Cooking Device Campaign

From all reports the best way to make people want heating and cooking devices is advertising by trial. The plan is too well known to require description in detail. It consists of placing in the home of every desirable prospect an electric iron, toaster or grill, to be used for a period of time usually from two weeks to a month, to be billed at the end of that time or to be returned to the solicitor. Reports show that from 60 to 75 per cent of the devices stay "put." The advertising to boost this plan can best be done in the newspapers, or by enclosures with the monthly statements, or by the house organ and letters addressed to a selected list of prospects. Store demonstrations and afternoon teas served at club meetings, church fairs and other gatherings at which all the cooking is done with electric utensils will create much interest and an active desire. Careful records of devices sold will show the prospects to be used for other devices and small power equipment. Some central stations plan to send a representative to call upon each customer at least twice a year. In such cases, there is an accurate record kept of all devices installed, as during each call the representative learns of all the electrical equipment in the home.

Vacuum-Cleaner Campaign

Probably the most successful vacuum-cleaner campaigns are direct-by-mail supplemented by a quantity of newspaper advertising and continuous window demonstration of the cleaners and their operation. It is necessary, as a general thing, to get a prospect into the store in order to sell a vacuum cleaner and to do this it is found profitable to have "vacuum-cleaner days," sending out invitations broadcast to attend a vacuum-cleaner demonstration in the salesroom. These invitations, if properly worded and neatly printed, will draw large crowds to the salesrooms and by having a sufficient number of good solicitors present, the actual prospects for vacuum cleaners can be singled out from the throng and the sale closed.

The manufacturers are anxious to supply this direct-by-mail advertising, and prospect lists which will indicate the better-class of homes in the city, are readily obtained from plots or from cards. In these direct-by-mail campaigns letters will of course be the bulk of the work as in direct-by-mail advertising. Telephone work, *i. e.,* having the lady of the house called up and invited to the store, has proved a good advertising feature.

FIG. 4. COMMERCIAL SECTION LITERATURE HAS BEEN OFTEN AND SUCCESSFULLY USED IN THE REGULAR ADVERTISING OF SMALL CENTRAL STATIONS

Commercial Campaigns

Usually the campaign to induce the storekeeper and the office manager to use more service is based upon lighting, this being the entering wedge to secure small power and heating business. Many central stations make a systematic campaign for commercial business, using the newspapers for advertising store lighting, office lighting, power for the different classes of stores and offices, electric signs, etc. Commercial lists are easily obtained from directories, and occasional letters carefully duplicated or typewritten are used to keep the policy and service of the company before commercial customers. Much of the selling of commercial installations must be done by personal solicitation; it has proved successful in some cases to send a retouched or composite photograph of such a merchant's store properly lighted and displaying a burning sign. Such a photograph will get favorable attention, but is too costly for general use.

Power Campaigns

The power prospects in a small city are few and most of the work to sell power is done personally by the manager or the solicitors. Power can be advertised in the newspapers but the waste of circulation is enormous. A well-prepared report on the requirements, conditions, costs and equipment needed is as excellent advertising for electric power as can be prepared. Letters carefully typewritten will serve to keep the central station before the power prospect. These can be sent out at regular intervals.

CO-OPERATIVE ELECTRICAL ADVERTISING

For three years there has been tried out on a very extensive scale a plan for co-operative electrical advertising which is of particular interest to the central station. In Cleveland this plan is known as the People's Electrical Page and consists of taking a full page three times a week in the leading newspapers. This plan has many objections, but when it is considered that without such a scheme the central station often does practically all of the local development work, while with it the supply dealers and contractors pay more than half, it is certain that the scheme has merit and almost any central station can well afford to back it.

Careful analysis has been made of the electrical advertising in eight cities, which vary in population from 50,000 to 600,000. Cities of equal population were compared; that is, Cleveland was compared with Baltimore, Buffalo with Detroit, Youngstown with Troy, etc. It was found that the total number of inches of electrical advertising in cities where the electrical page is appearing was 80 per cent more than in cities where it is not. This figure is a good general average which we obtained from checking two weeks' issues of the papers in two sets of cities, dividing the number of inches of electrical advertising by the total number of display advertising pages in the two cities, in order to eliminate the newspaper factor, since some newspapers may be more aggressive than others. In the two sets of cities the central station was doing practically the same amount of advertising. The increase in electrical advertising is sufficient justification for the electrical page. Aside from this, the page is an opening wedge for mutual co-operation and harmony; it is something that really proves whether or not the local electrical interests are in for co-operation, or are merely considering co-operation from a small-talk point of view. Its effectiveness as an advertising medium cannot be questioned. Tests have been made time and again in the Cleveland papers to learn just how effective the advertising was, and it has been thoroughly proved that the page is read and accomplishes an educational purpose.

A central bureau for the dissemination of news and editorial copy for the electrical page can do the best editing at least expense, and it is to be hoped that the Society for Electrical Development will establish such a bureau so that any central station desiring to run an electrical page can obtain the best type of news and story copy. A full page of electrical advertising is an excellent competitor to the advertising of department stores, and it would certainly command much more attention.

HOUSE ORGANS

House organs in the central-station industry have continued to grow from the first electrical advertising. There are a number of good house organs used co-operatively by several central stations, and, in general, these can be used by the small central station to good advantage. The cost of the house organ is not great where it is purchased in bulk from the publisher. The cost of the circulation depends largely upon the method employed. The house organs are circulated, some with the monthly bills, some from the corner drug stores, others from the lighting company offices, and still others are mailed under separate cover. "The Silk Cord," published by the Electrical Development Association, of Boston, is new and exceedingly interesting. It will be profitable to every central station to review this publication. The new publication of the Rae Company, called "Electric Service" and "The Electric City Magazine," published in Chicago, have an ever-increasing circulation among the smaller stations.

The larger central stations have issued during the past year, a Manual of Policy and Practise, which is designed to educate the public to a more reasonable use of the service. The more perplexing problems of the average customer are readily solved when he knows the conditions under which the central station struggles, and such manuals as that recently issued by the Commonwealth Edison Co., Chicago, and others, are valuable in spreading general information.

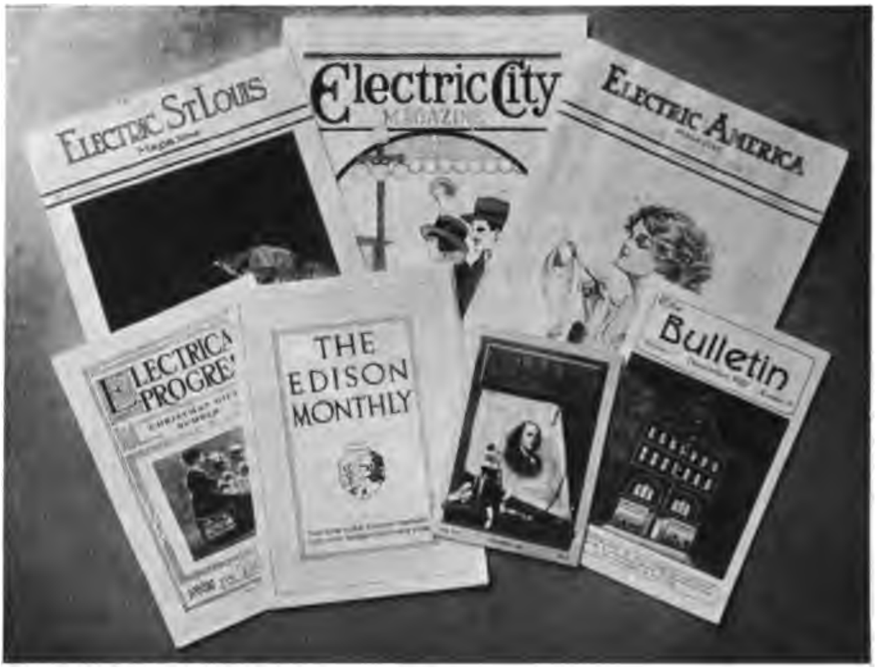


FIG. 5. CENTRAL-STATION HOUSE ORGANS WORK CONSTANTLY—BUILDING GOOD WILL AND EDUCATING THE PUBLIC

NEWS AND EDITORIAL WORK WITH THE NEWSPAPERS

The news and editorial columns of newspapers offer perhaps one of the best mediums of educating the public to an appreciation of electrical service and of fair and square dealing on the part of the central station. Too often a corporation is reticent concerning itself and this very fact causes suspicion. The newspaper will generally publish the truth if it is able to obtain it, and we consider it one of the prime duties of an advertising man in a small central station to know the newspaper men about him and to work with them and give them news concerning his plant. Once this habit is formed the newspapers will look to the central station for aid and assistance and the central station cannot fail to profit by the publicity given. There are hundreds of news happenings every day in the electrical business and the figures show something over 100,000 patents issued every year on electrical inventions. Considering this figure, think of the hundreds of thousands of new applications for service that come up every year. Every one of these applications contains something of news value and an active central-station advertising man will ferret this out and turn it over to the newspapers. It would be stimulating to the central-station advertising man if the manager would inquire regularly of him as to the amount of news which he has been able to turn over to the papers. We are not recommending press agency work of the old circus type, but rather the use of legitimate news to educate people to a fuller understanding of the service at their disposal.

THE SOCIETY FOR ELECTRICAL DEVELOPMENT

As the Advertising Committee, we look to the Society for Electrical Development for a great deal of help in the years to come. From the start made, it is manifest that advertising will be the main activity of the society, and it is our belief that value from this advertising will be realized in so far as the local central station in each community follows up the advertising of the society. The plans of the society advertising will be worked out by practical advertising men. The items advertised will be seasonable and definite, we believe, and every opportunity will undoubtedly be offered for a complete and thorough local follow-up in each and every city. Central-station advertising men will watch carefully the plans of the society, and they may increase the efficiency of their advertising a hundred fold. Real money is being subscribed for the Society's activities; it will produce results only through local following-up.

COMMERCIAL SECTION CO-OPERATION

The seven publications of the Commercial Section are fine specimens of advertising literature. Their general use during the past year and the insistent demands for further literature in the same style have proved their value. Any central-station advertising man who is not familiar with the list of publications of the Commercial Section should obtain them at once from the secretary of the Section, and he will surely find some place where he can use them to advantage. It is to be remembered that this Commercial Section literature is furnished at prices far below those at which material can be obtained in any other way and as many or as few copies can be obtained as desired. The publications have been prepared by experts and are of proven worth.

CONCLUSION

In concluding this report on central-station advertising a word should be added regarding the results to be expected from any advertising of specialties. In the first place, do not expect in every case that immediate returns will follow for every dollar expended. The results are bound to show in the long run, but are cumulative in their effect, each advertisement strengthening the one that preceded it and strengthening the market for the product advertised. Direct immediate results will undoubtedly be obtained from most advertising that is properly planned, but by far the greatest results are those which come through persistent working on the public mind to arouse in it an appreciation of the new slogan, "Do it Electrically."

Respectfully submitted,

Committee
J. ROBERT CROUSE, *Chairman*
J. C. McQUISTON
F. H. GALE
N. H. BOYNTON

PAPERS ON ADVERTISING PRESENTED AT THE N. E. L. A. CONVENTIONS FROM 1900 TO 1912, INCLUSIVE

TITLE	AUTHOR	YEAR
Report on Advertising Methods	La Rue Vrendenburgh	1904
Report on Advertising Methods	Percy Ingalls	1905
Free Signs and Flat Rates	C. W. Lee	1905
Co-operative Plan of Lamp Manufacturers for Business Promotion, With a Suggested Broader Plan	J. Robert Crouse	1905
Discussion on Advertising Methods	(By various members)	1905
Report—Committee to Co-operate with the Manufacturers' Advertising Committee	Paul Spencer	1906

Advertising Results Demonstrated	E. S. Marlow	1907
How to Make the Most of Newspaper Advertising	A. D. Mackie	1907
Measuring the Results of Advertising	M. S. Seelman, Jr.	1907
The Value of the Services of the Advertising Agency or Specialist	Laurence Manning	1907
Display Rooms and Demonstration as Business Getters	E. A. Davenport	1907
New Business by Indirect Methods	L. D. Mathes	1907
New Business by Indirect Methods	George Steinwedell	1907
The Display Room	L. D. Mathes	1908
Advertising Methods	Charles A. Parker	1908
Publicity	Percy Ingalls	1908
Electricity for National Advertising	George Williams	1909
Novel Methods of Advertising in Small Towns	Alex. J. Campbell	1909
Central-Station Advertising	H. K. Mohr and C. W. Lee	1910
Plan to Interest National Advertising In Electric Advertising	F. B. Rae, Jr.	1910
Report of Committee on Advertising and Publicity	C. W. Lee	1911
Report of Committee on Electric Advertising and Decorative Street Lighting	W. H. Hodge	1912

PAPERS ON OTHER THAN ADVERTISING SUBJECTS PRESENTED AT THE NATIONAL ELECTRIC LIGHT ASSOCIATION CONVENTIONS

BY MR. J. ROBERT CROUSE

Profitable Commercial Co-operation		1906
Report—Committee on Membership.	J. Robert Crouse, Chairman	1907
Co-operative Commercialism in the Electrical Field		1907

DISCUSSION

MR. WM. D. MCJUNKIN, Chicago: There is one statement in this Report which I feel like emphasizing: "Fully one-half of the work of the salesman can be eliminated by proper advertising." In a recent address delivered before a body of central-station men in Chicago, Mr. Samuel Insull, president of the Commonwealth Edison Co., said:

> "Formerly it was the custom of our solicitors to go from house to house in developing prospective users of electric light; but since we have adopted the system of consistent advertising in the newspapers, we receive sufficient inquiries by telephone and by letter to keep our solicitors busy from this source alone, and at certain seasons we receive more inquiries than they can attend to."

I think that this is the thought you should take home with you. Advertising for central stations has, in my opinion, changed greatly in the last year or two. In former years, as it seems now, advertising was done without much thought being devoted to it; it appeared to be a matter of buying so much space for so much money and putting anything that might happen to come into the mind of the writer in that space. It looked very much as though central stations were merely trying to please the newspapers.

To-day we find the advertising of central stations on a business basis—a purely commercial basis. In other words, central stations are buying space in their local newspapers just the same as the clothing merchant or the shoe merchant buys it, to advertise wares. They are advertising and selling current through the use of that space.

The point I want to drive home is that advertising of this sort produces a two-fold result. In the first place, it proves profitable and brings the money back home. It advertises a device or an appliance in a legitimate, telling way, and is profitable for that reason. It also has a tendency to put a central station in the class of regular advertisers and soon the newspapers look upon the company as such. If central stations are to get a square deal and fair treatment at the hands of the newspapers—and that is all most central stations contend for—they will get that kind of treatment when the newspaper man feels that his space is being bought and used for business purposes and not merely as a favor to him.

Another point I wish to emphasize is the placing of your advertising under one head or management. In the larger companies it is in charge of an advertising committee; in the smaller companies one man can look after it.

It seems to me that the solution of the advertising problem, especially for the small central station, must come through co-operation. The central station spending a thousand dollars a year, or possibly less, for advertising, cannot afford to have an advertising service prepared especially for it. It cannot afford an advertising manager nor special and expensive drawings and illustrations.

In this connection, I feel it may be proper to recite a personal experience of my own. About two years ago, Mr. John F.

Gilchrist, of the Commonwealth Edison Co., suggested the advisability of getting out a co-operative advertising service for small central stations. It was Mr. Gilchrist's thought to do something for the industry as a whole, but particularly for the small company which could not afford individual service. Following his suggestions, plans were worked out and after being perfected were submitted to Mr. Insull for approval and received his endorsement. This co-operative plan is now in effect, and over 150 central stations throughout the country are using it.

It is not the purpose of the people back of this co-operative campaign to make a profit. It is not intended to make a profit, but to cover only the actual cost of producing the matter and the necessary expense of handling it. Under this co-operative service, the advantages to the small central stations are readily apparent. The service, as planned, and now being produced, will cost something like $7,000 a year, to which must be added the additional cost of handling it.

To start this service Mr. Gilchrist contributed 100 complete advertisements of the Commonwealth Edison Co. to be used as a reserve supply. Each company participating is given the privilege of selecting 25 of these advertisements to start with, and ten additional advertisements, new and on timely subjects, are sent to each company every month. This means that 120 new advertisements are sent out during the year which, added to the 25 in the reserve supply, makes a total of 145 received. I think there is no question that a co-operative plan of this sort will do much toward solving the advertising problem of the small central station.

The manufacturers are doing good work in sending out cuts and copies of booklets gratis. If there has been any handicap to their work, it is the natural inclination to boost their own products—to advertise their special makes of fan, motor, or some of a thousand and one things electric. I think the co-operative plan, which deals simply with the problems of the central station, is more effective.

In the co-operative service I have spoken of, proofs of the advertisements especially written for central stations and the cuts of illustrations to be used therewith are sent out separately; the idea being to make the service or copy fit the needs of a central station—that is, have it so that the central-station man can change it to suit local conditions. The form in which the copy is sent permits using a part of it, all of it or none of it, as the central-station man sees fit. The illustrations contained in the service may be used with entirely different copy and in an altogether different way.

Too much emphasis cannot be laid on the quality of the copy that goes into your space. I think it is far better, as has been aptly said, to put $50 copy in $5 space than $5 copy in $50 space.

MR. N. H. BOYNTON, Cleveland: This paper is only a start on what subsequent committees can keep up; the securing of advertising for small central stations. In looking up references on this subject there is very little material to be had. There have been several articles and reviews on advertising campaigns, but as far as recognition of the small station and recommendations of advertising for the use of small stations go, I am unable to find any. There are faults in this Report, no doubt, which can be ironed out during the discussion and in the course of the coming year. I hope to hear another along the same line at the next Convention. First, there is a plea for the serious consideration of advertising. Put in on the same basis as your engineering. It bears the same relation to selling that engineering bears to operation. We are too apt to decide what is good or bad advertising, just by looking at it. Get away from that. Consider advertising as it is used. Another thought I want to repeat is that a salesman's time is too valuable to be spent doing anything which can be accomplished by advertising. The cheapest kind of salesman costs his company at least a cent a minute while he is on the job. You can send out a pretty strong advertisement to prospective buyers based on a salesman's time at a cent a minute, and can complete a larger number of sales than by the other method, and for this reason, advertising should have the serious consideration of every small station.

MR. SEELMAN: I rise to compliment and congratulate the Advertising Committee on its Report. I consider it the best advertising paper of any kind that has been presented before this Association. It is practical, sensible, useful and valuable. It goes right down to hard facts, gives the results of the experiences of many companies, and codifies this experience so that any company can use it. In spite of the fact that it purports to be for small central stations only, I am surprised to find so much that is applicable to and suitable for advantageous use by large stations. I think it should be studied and utilized by all stations, small and large.

Mr. C. W. Lee, New York: I heartily agree with Mr. Seelman that the Report of the Advertising Committee is the best effort that has ever been presented to the Association on this subject. It strikes a new note and carries new thought. It shows progress on what might be termed the advertising side of the industry. There is a proneness among central stations to criticize individual pieces of advertising copy, the criticism coming from men who do not make advertising their business. The Publications Committee has presented its Report. It is a report of progress. There have been individual pieces of literature published along various lines. While they stand out as individual pieces of literature, still, to get the best results, they must be used in a constructive way in our advertising campaign and be made a part of it. Another thought which harmonizes with the advertising end and which was touched upon more particularly last night in the Report of the Public Policy Committee is that newspapers should be utilized in presenting the policy of the company, of the public utility, to the community. Now, as an industrial proposition, we have failed woefully in this respect. To-day we are in a new era. Many new problems, National, State and municipal, are confronting this nation, and wherever local issues are brought up, franchises, rate situations and other of the kindred evils, the local public utility represents to the people of the community all that is evil in corporation management. We have had ten years of muckraking in National magazines and periodicals, and in the daily newspapers, in all of which corporations have been attacked. Now, in the local communities, the public utility is really the only big corporation and all corporate sins are attributed to it. This National spirit of unrest is sometimes centered against a local public utility not in the least to blame and trying to placate the public. Let us keep our newspapers in trim. We are doing things all the time that are of public interest. Tell the newspaper men about it. Let them get accustomed to coming to the office to secure news of our doings. In that way we shall be getting before the people in the right light, so that when a question of real importance comes up we will be in better shape to make the necessary fight.

MR. ELKHART, Philadelphia: I want to return to a point that was brought out yesterday about these manufacturers' publications. We have found it impossible to use them on account of the printed price list. It is my suggestion that no prices be shown in these booklets. I want also to call attention to several advertising campaigns, or rather advertising stunts which we have put through. We have a very wealthy suburban district outside of Philadelphia, which is hard to reach either by salesmen or by advertising. A salesman out there is stopped at the door by a servant, and advertising matter is thrown away. We find the only way to get attention in that district is by a little card that goes with the gas bills. That point was brought out in Mr. Jones' report, and is, I think, a very effective method of advertising. These cards come back every month. The return is as high as 20 per cent. Of course, I do not mean that 20 per cent in sales result, but the return shows an interest. Another campaign was in window lighting, through the medium of the daily newspapers. We had the merchants of the town write us letters endorsing our window-lighting system, and these we reproduced in the daily press, accompanied by pictures of the merchant's store, in half-page space. Now, the merchant got good advertising out of that, and we had simply an army of men coming in to ask if they could have their letters printed.

"Mr. Crouse brought out briefly the campaign of The Society for Electrical Development. Everybody should be a booster for that. We can point to the great success of similar campaigns. The British Gas Association has carried on one in their kind of business. They started out with an appropriation of $75,000 for 1912, and their work was so successful that in 1913 they doubled it. You all know the success of the Bell Telephone Companies' national advertising. I have heard men ask, "How are you to do it?" Yet, there is nothing new in it. It is simply straight national advertising. The Gas Association, as you possibly know, has just collected a fund in the way that The Society for Electrical Development is endeavoring to raise money, and you can see the immense good that public utilities will receive through this method of advertising. Irrespective of the fact that it has to do with merchandizing it is going to place public utilities in the proper light before the public. We want all the friends we can get. We want to tell the truth and to live down a lot of the misrepresentation under which we have been working. I think that this Section should boom both campaigns. It is a great, big movement, irrespective of whether it is for gas, electricity or what not. We should all join in it. I have not the exact figures but on an assessment basis it amounts to about one postage stamp per consumer per year. Who is going to consider a cent? The assessment amounts to practically nothing at all. I want to make an earnest appeal that we all take a prominent part in this boom of The Society for Electrical Development.

MR. T. F. KELLY, Dayton, O.: I think it may be interesting at this time to pay a compliment to Mr. H. K. Mohr, who first adopted the slogan, "If it is not electrical, it is not modern." We have used this slogan in Dayton in a unique advertisement, which appeared in a newspaper recently. A landlord inserted the following: "House for rent in Dayton View, seven rooms, modern, except electric light." I believe that is the first time a landlord ever made so frank a statement. We followed this advertisement up, had a talk with the landlord, and fully expect to wire his house, but, what is more important to us, we received permission from him to use his advertisement in our own matter, and we did so in this way: "Landlords realize it is much easier to rent their houses when wired for electric light. Therefore, why don't you have your house wired at once? Ask us now. If it is not electrical, it is not modern."

THE CHAIRMAN: The next number on the program is a paper on Advertising the Electrical Industry by Means of Reading matter, by Mr. John G. Learned, of Chicago.

ADVERTISING THE ELECTRICAL INDUSTRY BY MEANS OF READING MATTER

In this age the value of publicity is generally appreciated by the progressive business man in almost every industry. I do not refer merely to advertising; the importance of that in its various forms is tacitly conceded, and its necessity to proper business growth recognized in the advertising appropriation which is part of every modern business budget. I refer to the effort to interest the public in certain things through the magazines and newspapers, quite outside of the channels of ordinary advertising.

In the broadest sense, of course, publicity includes all forms of advertising; and on the other hand, advertising of any sort makes for publicity. For the purpose of this paper, however, we will consider the two as being entirely separate, even though complementary parts of the means to a common end—the development of a bigger market.

To every industry there is both the commercial and the human-interest side. With the former are concerned all directly connected with the industry, either as part of the various agencies of production and distribution, or more remotely as consumers of the commodity furnished. The human interest side appeals not only to all of these, but to the great mass of people in no way directly related to the industry.

It is the intelligent presentation to the public of this human interest side which constitutes effective publicity. And the theory of the thing is this: that the greater the extent of public interest in your proposition, and the more you can get people to know about it as a matter of news or general information, the easier it will be to interest them in your advertising and the more likely you are to secure their business.

The electrical field is especially rich in human interest features of the sort that furnish excellent publicity material. On this account the industry has always received much valuable publicity which is, so to speak, purely spontaneous.

We are safe in assuming that the wonderful growth of our business is due in no small measure to this fact, and that it has been a great aid to our own efforts to develop the field. It is only the most obvious publicity, however, that occurs in this way.

There is much good material, which could be made of great value to us, constantly passed by for the lack of proper handling.

Preparatory to considering methods for saving and using such material, let us look at the one big difference between the advertising section and what are generally termed the reading pages of any newspaper or periodical. Space in the advertising section is sold to the advertiser, who is at liberty to tell his story, or make his appeal as he sees fit, so long as the subject-matter and its manner of presentation conform to the publisher's rules and standards. It is not, strictly speaking, within the province of publisher or editor to decide whether or not any advertisement may prove of interest to a large number of readers. With subject matter for the reading pages, however, this is the first consideration.

An advertisement may be interesting to a number of readers, but a reading article must be interesting to the greater portion of them in the judgment of the editor before he will accept it. That is his job; to provide interesting material for his readers in keeping with the particular purpose of his publication whatever that may be.

His task is not always the easy one, and he is ever on the lookout for "live stuff." If you can furnish anything that measures up to his standard of interest-value, he wants it and is glad to publish it, regardless of any incidental benefit which may accrue to you as a result.

He will probably be careful, however, to see that you get no direct "free advertising," and your stuff must be of such a nature and in such shape that he can use it. It is the intelligent handling of such matters that constitutes the work of the publicity man.

As a proof of the general recognition of the value of publicity in the central-station field, let me remind you of the special attention being given the subject by The Society for Electrical Development. They have, I understand, arranged for a very thorough, comprehensive publicity campaign aside from their regular advertising. This publicity work will be in the hands of men well qualified for the task and we may confidently look for great benefits to the entire industry as a result of the society's efforts along this line.

A striking illustration of the wealth of publicity material in the electrical field and of the possibilities of making our stories intensely interesting as stories, yet educational and of distinct advertising value, is an article entitled "The Power that Serves," in the May number of *Harper's Monthly*. This is a story undoubtedly written because its possibilities for brilliant and attractive description appealed to the author. Still, from the point of the electrical interests of the country it has very great value. It turns the minds of readers to the electrical industry in the way that similar magazine articles have toward other industries; as, for instance, the articles on steel production, on the great textile industries, the manufacture of building material, and others in a popular vein descriptive of many operations in the industrial world.

Of like interest and value are the articles of Mr. H. Bedford Jones on the great electrical manufacturing plants, which have been appearing during the past six months in a well-known electrical periodical published along non-technical lines. Articles of this nature, being both entertaining and educational, make a strong appeal. At the same time they bring home to the average reader the wide scope and wonderful ramifications of the electrical industry, the many ways in which it is striving to serve the public and the great part it is playing in the world's progress.

By giving consideration to this matter and having some one, whose duty it is to inspire and encourage such articles and direct the attention of writers to the fitness of certain electrical subjects as the basis for strong human interest stories, we could undoubtedly have a great deal more of such very high-class matter put before the public.

The central station should come in and encourage the production of such matter financially by seeing that it tends to increase the profitable circulation of the publication in which it appears.

Could any central station better expend a portion of its advertising appropriation than in arranging that matter of the character referred to gets very wide currency among its patrons and prospective customers?

In addition to exploiting and circulating such articles in newspapers and magazines, very much can be done by encouraging entire books or magazines dealing in a popular way with all that is electrically spectacular, practical or in any way attractive to the great body of general readers. In various fields such magazines started purely for the support of an industry have developed into wonderful popular periodicals. This avenue of publicity should not be lost sight of by the electrical people.

It is easy to see the benefits to be derived by those engaged in furnishing any commodity through the publication of a well-written and set-up magazine dealing popularly with their industry. With such a magazine for his field in general circulation, it is certainly very much to the advantage of any operator of a large public utility to co-operate with the publishers to the fullest extent in securing the greatest possible number of readers for the magazine in his vicinity. And should such co-operation necessitate some expense, could advertising money be spent in any better way?

This view of the subject is one that should receive very careful consideration from this Association.

(Adjourned.)

THIRD COMMERCIAL SESSION

THURSDAY, JUNE 5

THE CHAIRMAN, MR. E. W. LLOYD: The first number on the program is one of much importance to all companies serving territory not confined to one city, and that is the subject of Electricity on the Farm or in Rural districts? The three Reports are to be read first and discussed together afterwards. Mr. Parker, of Rochester, Chairman of the Eastern Section, will present the first report.

MR. J. C. PARKER, Rochester: I have some hesitancy in presenting a Report on the subject mentioned, which has, to some extent, always been considered a joke. I certainly believe, however, that the extending of our lines into rural districts offers the one new field which we have not attacked, and it is valuable because the business secured will be inherently off-peak load. Your Committee regrets that some of the advertising matter circulated has been of such a character that it has made the management of certain companies feel that it does not apply to their particular cases. It is not quite easy to see just how the farmer is going to be interested in a business way by presenting him with advertising literature portraying a trim young woman, with a fancy coiffure and an elaborate maid's costume.

REPORT OF THE COMMITTEE ON ELECTRICITY ON THE FARM

EASTERN STATES

The Committee on Electricity on the Farm has held approximately monthly meetings since appointment, and has investigated the field for rural extensions in this section of the country, as well as the work already being done. It was a more or less foregone conclusion that no considerable amount of typical installation has been accomplished. Because of the extremely old geologic formation of the eastern section of the country, the earth surface is very strongly broken up into small but vigorously undulating areas of widely diverse soil texture, at once precluding the extensive irrigation that has been carried on in the West, and forcing the development of comparatively small fields of highly diversified crops.

This eastern territory, owing to the fine network of steam railroads, the topographical conditions and the habits of the people, has not developed an extensive network of service lines for the operation of electric railways, such as is found in the Middle West.

On the other hand, your Committee finds very considerable areas where intensive crop developments obtain, notably the Connecticut Valley, the truck region of New Jersey and the truck and orchard belt in northern and western New York. In all this eastern territory the Committee is well convinced there is opportunity for very great extension of electric lines into the rural district, especially in view of the intensive character of farming absolutely essential in this region.

Your Committee believes that the work of farm extension must be primarily the concern of the smaller companies, since they offer a much larger circumferential zone in proportion to the area served by them than large companies under the conditions of our great cities.

As the eastern development of electricity on the farm will be in the service of small units, owing to the relatively large number of small farms, it is essential that the unit investment by the companies per customer served be kept at a minimum, and that the cost of the installation on the individual farm be also kept small commensurately with the farm area. The Committee finds considerable encouragement in these directions through the introduction into the market of bi-metallic wire of comparatively small carrying capacity and high mechanical strength, enabling the use of wider spans, and in the assurance given by manufacturers that inexpensive, simple and comparatively dependable protective switching and transforming apparatus will shortly be available for taps on high-tension lines.

While the nature of the distribution to the rural communities must be a question local to each company rendering such service, your Committee recommends that such distribution be made polyphase wherever this is economically justifiable, in order to give the farmer the opportunity to purchase inexpensive rugged polyphase induction motors in preference to single-phase motors which are necessarily more complicated in design and construction.

The wiring installations for individual farms must, of necessity, be inexpensive and rugged, and the motor applications must be of as wide a degree of utility as possible in order to keep down the first cost. In this latter connection the Committee has high expectations from the development now under way of a line of motors in a few well-defined standard sizes, mounted on trucks capable of ready anchorage, either indoors or out, and arranged for a wide diversity of speeds so as to be applicable to a variety of agricultural machines. The Committee recommends to the manufacturing companies that such motors and trucks, when developed, be made simple and independent of auxiliary tools for repair and operation, that lever cams be used for locking in place of bolts, and that the general details be executed along the line of these specific suggestions.

The Committee is fully cognizant of the fact that high excellence in efficiency is desirable, but would emphasize the fact that the efficiency to be developed must be commercial rather than technical. Reference to the appended summary of tests on electrically operated farm machines will show that a variation in the cost per kilowatt-hour from one cent to 10 cents produces a relatively small variation in the total operating cost, including interest, depreciation and labor; and, therefore, urgently recommends that a proper balance be struck between first cost and economy in energy utilization. It will probably be found in the case of most farm installations, that within the range of ordinary equipment, technical efficiency will be entirely subordinate to the matter of first cost, especially on apparatus the use of which is intermittent.

The general findings of the Committee are perhaps best covered by the following letter, prepared for circularization among the managers of electrical companies in the Eastern States. As will be noted from the body of the letter, little has been found in the way of typical development in this eastern territory, and, therefore, the letter is at once a warning against ill-considered experimentation which might result in ultimate discouragement, and, on the other hand, a stimulation to the recognition of the large opportunities presented.

THE LETTER

To the Managers of Electric Companies in the Eastern States:—

You are, of course, intensely interested in building up your annual load-factor. You realize that every bit of load that is inherently a summer demand works to this end, irrespective of its load-factor. You know that in the summer time you can supply a great deal of additional energy, especially during the daylight hours, without one cent of extra investment in your power house or transmission lines.

In farm applications you have just such an opportunity, since practically all of the farm operations must be conducted in the summer months and during the daylight hours. You surely realize that this is worth going after, and worth offering reasonably favorable rates to attract.

Perhaps in the past this business has seemed unfavorable because of its relatively low density, as compared with your urban load, and you have felt that the additional investment to get from your present lines out into the rural districts was disproportionate to the revenue to be obtained. Now, however, the manufacturers are offering us protective devices and small transformers at comparatively modest cost and at sufficiently high voltages to enable us to tap at least our main extra-urban lines for farm use.

Perhaps you have been discouraged from rural extensions by a great many of the devices advertised, and a great deal of literature which has not appealed to you as being particularly practical. This is to be regretted, since the obvious association of ideas has led you to think that electrified agriculture has no place on the real farms in your neighborhood, but must be confined to very large country estates or similar non-typical cases; whereas, in fact, the electrification of the farm is a real business opportunity, and entirely practicable if attacked along practical lines.

One or two rural developments have been much talked about; but, in these cases, the Committee finds that they are ineffective in getting results. These are cases where central-station companies, in going from town to town, have been able to supply "gentlemen farmers" with luxuries in large quantities and at fairly high prices, or where transmission lines, run for other purposes, have passed through rich suburban farming sections, where the land could not be purchased at $1000 or $1500 per acre. These installations are not typical, nor is the application of electricity to such properties as the Deerfoot Farm in Massachusetts, which is really a group of city sausage factories or dairies transferred into the country. You have been perfectly right in assuming that the application of electricity to a farm manufacturing two tons of sausage daily had not a particular message for you.

But is it safe to assume that because we have not electrified many typical farms, it is a thing that cannot be done with profit, or that should not be done? Your Committee thinks not. The Committee, in fact, is sure that with work seriously prosecuted in the right way, farm extensions are going to be worth while, just as industrial service is practicable in the cities, just as you have built up a fine off-peak vehicle-charging load.

This business, however, is not going to come to us without our taking the initiative. The electric vehicle, the flatiron, the general power motor, and even the electric light did not come into their own without your having had the courage of your convictions and embarking a slight amount of capital before you had the revenue to be gained actually laid down across your counter. The message of your Committee in the Eastern States is that your rural revenues are a great deal more certain to-day than were the revenues from flatirons, motors and lamps when you first took them up.

There is one and only one definite way in which you can build up the farm business with certainty. You have got to show the farmer that \$5.00 invested in energy and energy-utilizing devices will bring him a certainty of at least \$6.00 gross return from the investment, or the investment will not be made. The farm will have to be attacked as an industrial proposition, and energy and devices sold on their earning power and not on central-station enthusiasm alone. You have got to be able to talk in terms of crop yield per acre and market prices for cabbage, rather than in terms of the kilovolt-ampere.

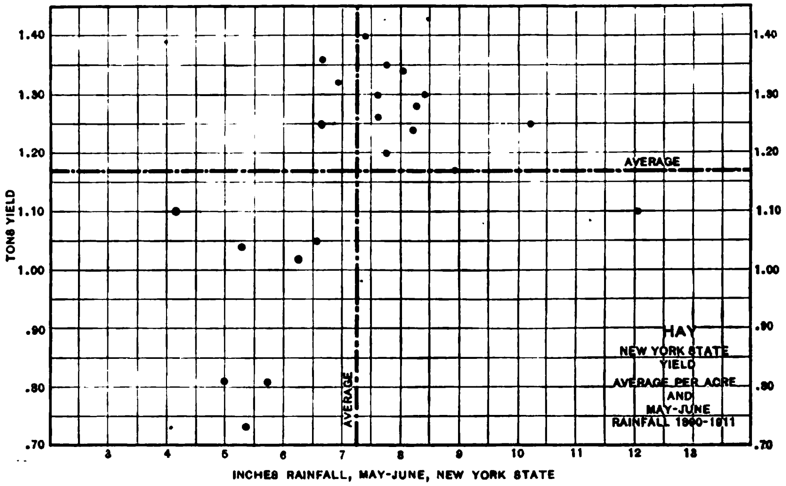
Now, the way to get at this, your Committee feels, is to find some part of your territory where the topography is promising, and where you have the transmission lines already running for, let us say, a trial proposition or two in some one of your suburban towns, and then to find some farmer within the territory who is willing to help you make a demonstration during the coming season. If the demonstration will open a new field of business for you, it is worth \$300 or \$400, or maybe a couple of thousand, to make it.

One of the most promising lines just at present is that of irrigation. The western farmer has had to irrigate in order to get crops at all, and, in addition to this, he has had to cultivate and to study marketing conditions; but out of his necessities he has been able to produce crops infinitely better than Dame Nature would have given him. It is a fair inference that we, in the east, can do at least as much by augmenting our natural precipitation as he can do with the freight odds against him.

There is a chart attached, which shows what the rainfall has done for the hay crop in New York State. See what one or two inches of water during two months have been able to effect. It is fair to infer that if the best years under natural conditions have been so much better than the worst, normally good artificial irrigation would show results materially better than the best natural irrigation. Remember that this chart is compiled from State-wide data, and that it therefore does not show the best rainfall or the best crop yield in New York. Does it not follow that, if this law obtains for a coarse field crop like hay, it will apply with even greater force in the more valuable crops and in those depending entirely on water for their best yield?

Your Committee does not particularly recommend hay as the crop on which you should make a demonstration. In fact, the irrigation of field crops may be some distance in the future, but these data are included as the only specific information we could get for our section of the country, showing the commercial results of precipitation, and are an indication of what may be found true to a much larger degree of other crops.

How to go about it? The Committee recommends that you place a man on the problem right now before the spring plowing is done, find a farm sufficiently near your transmission lines, sufficiently near a creek to get the water supply and on ground not so rolling that irrigation works will be prohibitively expensive. The farmer should be sufficiently wide awake and progressive to appreciate what the problem means, and then the central-station company should offer him the loan of the equipment and the energy for the first season, and irrigate about half the farm, leaving the other half unirrigated, but subjected to identical cultural treatment. Get in touch with your State Agricultural Experiment Station in carrying out these experiments. This will add value. Then you will have a talking point, an object lesson and relative data for your own commodity. If next season is a dry one, or if the rain does not fall at the right time of the year, this irrigated section should bring off heavy crops at the best market prices.



Of course, truck gardens are the best place to make this demonstration, but it will be tremendously effective in connection with small fruits or orchard crops. If you cannot find a convenient truck garden, berry patch or orchard near your lines, but have access to a favorably located general farm, you can certainly make a showing there, remembering, especially, that it costs the farmer no more to take a $25 crop off an acre that it does to take an $18 crop; so that, if the season's cost for irrigation is less than $7 per acre in such a case, the difference represents clean profit to him, with the irrigation cost paid for.

The thing to impress upon the farmer is that this irrigation is crop insurance, so that not only will he get a better yield, but will insure his yield in seasons when neighboring unirrigated farms fail and when he can take advantage of the highest prices.

The companies in the West have done great things along these lines, the Pacific Gas & Electric Co., with a generating installation of 169,300 kv-a., to which an additional 55,000 kv-a. will shortly be added, having actually shifted their peak load by these means from the winter to the summer months. Perhaps you will say that farm business in the West is different from any in the East. This is true, both in climatic conditions and in the temper of the people. You will not acquire the same large single installations that the western companies have; but then you will acquire so many more customers that the possibilities are probably nearly as great. Get hold of Bulletin 148, published by the Department of Agriculture in 1903, and read what the possibilities are on the eastern farms.

Be sure that the man you put on the work is the right man. Mediocrity will not do with the farmer; he is a business man and appreciates a gentleman just as much as the city merchant does. He will, therefore, want to deal with a man who can talk business without affectation, and who has vision enough to see the possibilities of his own work. The man must have good sense, of course. An impractical enthusiast will not create sufficient confidence to open up even the demonstration work.

As to your plans, what shall they be? Well, in the first place, if you do not want to predict discouragement for yourself, as well as for your farming community, do not try to cover all the territory at once. Select the outlying portion which you will be able to serve most readily on a real business basis. Make your demonstration there this summer, and next fall, as soon as the crops are in, send your man around from farm to farm and work up the business. It may be you will have to put trial installations on a few of the farms next year; certainly you will have to take your payment in installments, and, preferably, when the crop has been brought in. Be broad gauge in this; follow the example of the mowing-machine man.

Above all else, do not advertise in the papers. Circularize the narrow community where you are going to be able to deliver the service at once, but do not arouse an interest in the next township and then let this interest fall flat. It will be harder to re-awaken the interest when you get ready to do business if you have stifled it half formed. When you have circularized, have your farm man follow up—and follow up hard—and close the order.

It may be that the way to get in is not by irrigation. Each company will have to solve the problem for its own territory. If you are located in a dairy community, you will have a problem different from that of a community devoted to general farming. Land in New Jersey, devoted to sweet potatoes, does not offer an industry identical with the onion and tobacco land of the Connecticut Valley, or with the cotton crops of the Carolinas and Georgia. Whatever your territory is, select the best industrial opportunity and get it started. Then, next season, after you have shown two blades of grass growing where there was only one before, go out again and put a motor in place on the windmill and show the farmer how he can use the same motor to split his wood, and separate his cream, *et cetera, ad infinitum.* We believe it is a good deal the same in power sales in respect to electric cookers, vacuum cleaners and all that sort of thing, as it is in the spiritual line concerning which we are advised to take care of the real thing first, "and all these things shall be added unto you."

This, then, boiled down to the essentials, is your Committee's report:—

1 No sincere general farm applications have been made in the Eastern States.

2 These are technically possible with the present development of transmission devices.

3 They are highly desirable as giving the class of load the central station wants.

4 There is opportunity for power applications in the East as there was necessity in the Far West.

5 They must proceed along economic and business lines.

6 The central-station company must demonstrate to the farmer, at its own expense, the economic value of these applications.

7 The company must make good by giving service wherever it has created the demand.

8 The first step must be made where there is some assurance of success.

9 Next season's development must be confined to a limited territory.

10 A high-grade man must be put on the work.

11 Advertising must be by circular to a limited list of farmers.

12 The circulars must be followed up and pushed home.

13 Then transmission lines will have been made economically possible, confidence gained, and the general line of appliances will practically sell themselves.

SUPPLEMENT TO THE LETTER

Our letter has referred largely to the matter of irrigation as an indication of what may be done along that particular line. There are many other legitimate applications of electricity to farm use, a complete list of which cannot be given. Perhaps the greatest in importance, next to irrigation, is the dairy application, where power may be used for cutting ensilage, for milking cows, for operating cream separators and for churning. The two following tables show a list of the machines exhibited by the Edison Electric Illuminating Co., of Boston, in its "Farm of Edison Light and Power," and a summary of tests on electrically operated farm machines.

Committee for the Eastern States

John C. Parker, *Chairman*
H. W. Cope, *Secretary*
C. H. Miles
John Meyer
John W. Fox
E. P. Edwards
Fred M. Kimball

SUMMARY OF TESTS ON ELECTRICALLY

Operation	Capacity of Machine Per Hour	Size of Motor on Mach. Hp	*Size of Motor Recommended Hp.	Kilowatt-hours Required	1 cent
Grinding ear corn	40 bu.	15	20	0.411 per bu.	$0.0236 per bu.
Grinding shelled corn (fine)	41.5 bu.	25	15	0.272 per bu.	0.0139 per bu.
Cracking shelled corn	65 bu.	25	10	0.086 per bu.	0.0103 per bu
Shelling corn (cylinder sheller)	114 bu.	25	10	0.0448 per bu.	0.0119 per bu.
Rolling oats (crushing)	111 bu.	25	10	0.062 per bu.	0.0063 per bu.
Shredder and husker (6-roll)	1.95 tons	15	15	5.37 per ton	2.63 per ton
Cutting fodder	2 tons	10	15	2.08 per ton	0.314 per ton
Root cutter	5.78 tons	2	2	0.158 per ton	0.1135 per ton
†Threshing barley	145 bu.	15	20	0.1257 per bu.	0.00126 per bu.
Separating milk	1300 lb.	1½	1½	0.0386 per 100 lb.	0.0269 per 100 lb.
Churning, working and washing butter	100 gal. churn	2	2	0.617 per 100 lb.	0.219 per 100 lb.
Grinding sausage	750 lb.	4	2½	0.441 per 100 lb.	0.824 per 100 lb.
Sausage stuffer	116 lb.	¾	¾	0.0525 per 100 lb.	0.3745 per 100 lb.
Washing machine, capacity 12 sheets per washerful	3 washerfuls	¼	¼	0.0616 per washerful	0.0429 per washerful
Portable vacuum cleaner	1000 sq. ft.	¼	¼	0.0226 per 100 sq. ft.	0.0198 per 100 sq. ft.
‡Large vacuum cleaner	1640 sq. ft.	3	3	0.107 per 100 sq. ft.	0.091 per 100 sq. ft.
Horse groomer	7 horses	1	1	0.106 per horse	0.029 per horse

*This column shows the horse power of a motor best adapted to a machine of this particular capacity.

†The interest, depreciation and labor on the thresher are excluded in this calculation, as the machine was a custom machine and it was impossible to secure the number of hours it was used during the year.

‡The aggregate amount of work done, in this case, by the cleaner is too small to warrant such a large installation, because of excessive depreciation and interest.

**These percentages were figured from the actual tests and are based on one year's operation of the machine on the farm where it was tested.

OPERATED FARM MACHINES.

Operating Cost, including Interest, Depreciation and Labor, with Cost of Electricity from 1 to 10 Cents per Kw-hr.									**Cost of Labor, Depreciation and Interest and Power by per cent		
2 cents	3 cents	4 cents	5 cents	6 cents	7 cents	8 cents	9 cents	10 cents	Labor at 15c. %	¶Dep. and Int. %	Power at 5c. %
$0.0277	$0.0318	$0.0359	$0.0400	$0.0443	$0.0484	$0.0525	$0.0566	$0.0606	19.0	30.0	51.0
0.0166	0.0194	0.0221	0.0248	0.0275	0.0302	0.0329	0.0357	0.0384	30.0	15.0	55.0
0.0111	0.012	0.0128	0.0137	0.0146	0.0154	0.0163	0.0171	0.018	33.0	36.0	31.0
0.0124	0.0128	0.0133	0.0137	0.0142	0.0146	0.0151	0.0155	0.016	16.5	64.5	19.0
0.0069	0.0075	0.0082	0.0088	0.0094	0.0100	0.0106	0.0113	0.0119	31.0	34.0	35.0
2.69	2.74	2.79	2.85	2.90	2.96	3.01	3.06	3.12	2.7	88.0	9.3
0.334	0.355	0.376	0.397	0.418	0.438	0.459	0.48	0.50	18.6	55.2	26.2
0.1151	0.1166	0.1182	0.1198	0.1214	0.1230	0.1245	0.1261	0.1277	43.5	50.0	6.5
0.00252	0.00377	0.00503	0.00639	0.00755	0.0088	0.0100	0.01132	0.01258			
0.0272	0.0276	0.028	0.0284	0.0288	0.0292	0.0296	0.03	0.0304	10.2	83.2	6.8
0.225	0.232	0.238	0.244	0.25	0.256	0.262	0.269	0.275	35.6	51.6	12.8
0.087	0.091	0.096	0.100	0.104	0.109	0.113	0.118	0.122	20.0	58.0	22.0
0.375	0.3756	0.3761	0.3766	0.3772	0.3777	0.3782	0.3787	0.3793	70.6	30.6	0.7
0.0435	0.0441	0.0448	0.0454	0.046	0.0466	0.0472	0.0478	0.0485	18.2	75.0	6.8
0.0200	0.0203	0.0205	0.0207	0.0209	0.0212	0.0214	0.0216	0.0219	48.2	46.2	5.6
0.092	0.093	0.094	0.095	0.096	0.097	0.098	0.099	0.100	6.3	88.0	5.7
0.030	0.031	0.032	0.033	0.034	0.035	0.036	0.037	0.038	67.5	16.5	16.0

¶If the farmer had selected the proper sized machine, many of the percentages in this column would have been materially reduced.

These tests were made on farms under actual operating conditions. The kilowatt-hours required per unit of work will be approximately the same for either smaller or larger machines, providing they have been properly installed. Depreciation is figured at 10 per cent and interest at 6 per cent in all calculations.

Besides the saving in operating cost, the time saved in every case was quite large. Every farmer will appreciate this, as it will materially aid him in the solution of his labor problem.

MACHINES SHOWN BY THE BOSTON EDISON CO. IN THE *"FARM OF EDISON LIGHT AND POWER"*

Kind of Machine	Size	Cost	Maker	Location
Ensilage cutter	Ohio No. 11	$90.00	Silver Mfg. Co.	Salem, Ohio.
Feed grinder	Stover No. 4	27.00	Stover Mfg. Co.	Freeport, Ill.
Oat crusher	Gibson No. 16	300.00*	Gibson Oat Crusher Co.	Chicago, Ill.
Corn sheller	Favorite	35.00	Marseilles Co.	East Moline, Ill.
Clover cutter	8 in. feed	10.00	Ames Implement & Feed Co.	Boston, Mass.
Horse groomer	Priests No. 9	137.50*	American Shearer Co.	Nashua, N. H.
Hay hoist		18.50	Ames Implement & Feed Co.	Boston, Mass.
Nelson friction windlass		50.00	J. E. Porter Co.	Ottawa, Ill.
Wood splitter		133.00	Hildreth Bros.	Harvard, Mass.
Cord wood saw		25.00	Bauer Bros.	Springfield, Ohio.
Root cutter		13.00	Ames Implement & Feed Co.	Boston, Mass.
Cider mill		65.00	Ames Implement & Feed Co.	Boston, Mass.
Pump jack		15.00	Gould Mfg. Co.	Boston, Mass.
Pump	3 in. cylinder	173.00*	Gould Mfg. Co.	Boston, Mass.
Table saw	Crescent No. 1	71.00	The Crowther Co.	Boston, Mass.
Bone grinder				
Separator	650 gal. per hr.	150.00*	P. R. Zeigler & Co.	Boston, Mass.
Churn	100 gal.	155.00*	Creamery Pkg. Mfg. Co.	Chicago, Ill.
Milk tester	6 tubes	49.00*	H. E. Wright & Sons	Charleston, Mass.
Bottle washer		25.00	H. E. Wright & Sons	Charleston, Mass.
Milking machine	B. L. K. NO. 4	380.00*	D. H. Burrell & Co.	Little Falls, N. Y.
Brooder	60 chicks	14.00	Cyphers Incubator Co.	Buffalo, N. Y.
Incubator	60 eggs	16.00	Cyphers Incubator Co.	Buffalo, N. Y.
Sewing machine motor		25.00	The F. Bissell & Co.	Toledo, Ohio.
Vacuum cleaner		90.00	The F. Bissell & Co.	Toledo, Ohio.
Kitchen cabinet	5 machines	175.00	Federal Sign Co.	New York City.
Ice cream freezer		46.50*	F. E. Whitney	Boston, Mass.
Breast drill		50.00*	Western Electric Co.	Hawthorne, Ill.
Furnace blower		27.50	Electric Blower Co.	Boston, Mass.
Forge blower		28.00	Electric Blower Co.	Boston, Mass.
Fireless cooker	3 compartments	28.00	Detroit Fireless Stove Co.	Detroit, Mich.
Vegetable peeler	1 pk. capacity	150.00*	Morandi Proctor Co.	Boston, Mass.
Centrifugal pump	1½ inch.	190.00*	Rider-Ericsson Eng. Co.	Boston, Mass.

*Indicates price including motor.

Mr. Parker (continuing): Remember that power sales in rural communities must be made on the basis of industrial return. You must show the farmer where he will get back $6.00 for every $5.00 he spends. You cannot sell electricity to the farmer on a sentiment basis. Your Committee hopes that you will take this very brief report and consider it thoroughly to see if it does not open the way to business extension of a most lucrative nature. Call into consultation your engineers in regard to the matter of line extensions and tell them not to let their engineering instincts run away with their better judgment.

I would like to supplement the Report by a brief reference to a publication put out by the Publications Committee at the last moment. It is a booklet entitled "Farm Help," and was distributed yesterday. If you have any quarrel with the picture on the cover the Committee will not worry about that. That picture is not for you. That picture and the title are put there to attract the attention of farmers. If you don't like the photographs and the matter inside of the publication the Committee will not worry about that. The farmer will read it. The booklet starts out with an introduction by Mr. Bailey, who is the Charles P. Steinmetz of Farm Technique. We are not asking you to get these booklets and scatter them about your territory, but to send them out along the lines recommended. The Committee does expect that every member company having rural territory to serve will send in an order for at least 100 of these booklets which will cost from 10 to 15 cents each. One hundred copies mean only $15, and that is a pretty small shot to take in opening up this business. We recommend that you get the copies now and prepare your campaign. Then go right ahead, follow it up, and give service to your subscribers. Do that business during the early winter months, but be ready for it first. Strike your blow in December, or the latter part of November,. when the farmer has nothing to do but get ready for next season's business. You cannot strike in February or March, and you cannot strike in November or December, unless you start in immediately after the Convention is over. Take stock of what you are going to do with the business and get your campaign organized, or you will not be able to do anything this year.

The Chairman: I am going to ask Mr. Kennedy, of Los Angeles, to present the Report of Mr. S. V. Walton as to the situation in the Western States.

REPORT OF THE COMMITTEE ON ELECTRICITY ON THE FARM

WESTERN STATES

The Committee on Electricity on the Farm, Western States, consisting of:

S. V. Walton; Chairman, of the Pacific Gas and Electric Co., San Francisco, Cal.;
A. W. Hahn, of the Northern Colorado Power Co., Boulder Creek, Colo.;
S. M. Kennedy, of the Southern California Edison Co., Los Angeles, Cal.;
E. B. Walthall, of the San Joaquin Light and Power Corporation, Fresno, Cal.;
H. S. Wells, of the Pacific Power and Light Co., Portland, Ore.;
E. P. Edwards, of the General Electric Co., Schenectady, N. Y., and
H. W. Cope, of the Westinghouse Electric and Manufacturing Co., Pittsburgh, Pa.,

was appointed at the meeting of the Executive Committee of the Commercial Section, held in Boston early in October, 1912, for the purpose, first, of compiling data in order that it might issue a booklet for sale to member companies dealing with the subject of "Electricity on the Farm," as applied to conditions in the States west of the Rocky Mountains, and, second, of preparing a report on the same subject, to be presented at the Thirty-sixth Convention of the National Electric Light Association, in Chicago, in June, 1913.

Owing to pressure of other duties Mr. Kennedy asked to have Mr. Frank W. Balfour, of his company, appointed in his place. Mr. E. P. Edwards appointed Mr. F. E. Boyd, of the General Electric Co., in San Francisco, to represent him, and Mr. H. W. Cope appointed Mr. C. E. Hardy, of the Westinghouse Co., in San Francisco, to act for him on the Committee.

After the second meeting of the Committee it was decided that it would not be advisable to issue the booklet as intended, and the work of gathering data for the report was started by sending the attached list of questions to all the member companies located in the Western States, Mexico, Hawaii and Japan.

In preparing the list of questions the Committee endeavored to make it as complete as possible, realizing that few if any companies would be able to make very complete answers to all the questions, but with the idea in mind that the questions themselves would be valuable suggestions, which proved to be the case.

Out of 150 questions sent out answers were received from about 60, and nearly one-half reported that they were not handling any agricultural business, and, therefore, could not answer the questions.

The answers would indicate that the use of electricity for agricultural purposes in the West is most extensive in the States of Washington, Oregon, California and Colorado. The companies operating in the States of Idaho, Nevada, Arizona and Texas, and in Mexico, were very much interested and expect, in the near future, to get into the subject more deeply. Our conclusion from this is that hydro-electric power and electricity on the farm are to be close companions. An exception to this should be made for the Northern Colorado Power Co., the plant in this case being located in the center of the northern coal fields and power generated by the use of steam turbines operated with coal as fuel.

The various companies follow practically the same method in so far as construction of lines, voltage, phase, etc., are concerned, the practise being to extend the primary lines to a district at a voltage ranging from 22,000 to 110,000, depending on the area to be served and the load to be handled. Sub-stations are located at points which will become load centers and distribution lines of either 11,000 volts or 2300 volts (either delta or star-connected) are run to supply consumers.

In practically every case the consumer was asked to advance the cost of running the distribution lines and to furnish his own transformers when the business was first started and in the experimental stage. Most of the companies have now proved to their own satisfaction that the business is profitable and will support the entire investment of line and transformers, so that the consumer is not asked to pay for anything beyond the motor. This liberal policy has, of course, been the means of making electricity extremely popular, and in many sections it is the rule rather than the exception to see the farmer doing a great part of his work by means of electricity.

A most interesting point brought out was the great difference in the method of charging for power and the amount of the charge. At the end of this report are copies of rate schedules from various companies operating in the different States, showing rates in force for agricultural business.

The use of electricity on the farm is necessarily a seasonal use, the greatest demand being for pumping for irrigation. Depending upon the locality and on the crop to be irrigated, the irrigating season under normal conditions is from April to October, inclusive. A dry year, such as has just been experienced in California, will make the season longer. It was a common sight in the Sacramento Valley, in January of this year, to see the alfalfa and sugar beet land irrigated by pumping from the wells. It is very apparent, therefore, that it is to the power company's advantage to have the consumer make his installation as small as possible and operate it as many hours per day as possible, in order to cut down the plant investment of the power company and increase the return per unit of installed capacity. Some of the rates have been designed with this object in view, notably those of the San Joaquin Light and Power Co.

Your Committee feels that the rate subject is the most important of any of the subjects touched upon and hopes that a discussion will be brought out that will be of help to all concerned. The subject of "Electricity on the Farm" is of the greatest importance to those of the member companies who are located in agricultural communities, and the investigations already started by central stations and manufacturers should be followed up with even greater activity than heretofore. We, from the West, are possibly more dependent upon and interested in the agricultural development of our country, but we believe that the subject is of almost equal importance throughout our United States.

Respectfully submitted,

Committee
S. V. Walton — A. W. Hahn
H. S. Wells — F. E. Boyd
E. B. Walthall — C. E. Hardy
Frank W. Balfour

LIST OF QUESTIONS SENT TO MEMBER COMPANIES.

1—Name of Company ....
2—Location ....
3—Furnish map showing country distribution system of such type and size that cut can be made for printing.

4— Transmission.

Voltage............. Frequency............ Phase.............
Cost per mile Highway ....
Private right of way............................

Distribution System

Cost per mile Highway ....
Private right of way............................
5—Who pays for distribution?
6—If customer pays for lines, how?
7—If customer pays for lines, does he get his money back, and how?
8—Who supplies transformers and under what conditions?
9—If customer, does Company provide for buying back later?
10—Do you lease transformers: under what conditions?
11—Who supplies the meters?
12—Are meters installed on primary or secondary side of transformers?
13—Name conditions.
14—Does the rate to consumer differ depending upon location of meter?
15—Do you furnish polyphase service for small installations, and what is your minimum capacity?
16—How do you avoid supplying polyphase in small installations when it is your policy to furnish single phase?
17—Total number of customers?
18—No. irrigation pumping plants?......................Total hp......
19—No. reclamation plants? ....Total hp......
20—No. domestic pumping plants? ....Total hp......
21—No. general farm utility motor installations? ....Total hp......
22—No. installations heating and cooking appliances......Total kw......
23—No. of dairy installations ....Total hp......

24— Dairy Applications

	Number	Total Capacity
Refrigerating machines	....	hp............
Milking machines	....	hp............
Cream separators	....	hp............
Cream testers	....	hp............
Churns	....	hp............
Curd grinders	....	hp............
Cream ripeners	....	hp............
Casein grinders	....	hp............
Milk shakers	....	hp............
Butter tampers	....	hp............
Milk mixers	....	hp............
Circulating pump	....	hp............
Bottle washers	....	hp............

25— Barn and Field Applications

	Number	Total Capacity
Alfalfa mills		hp
Ensilage cutters		hp
Feed grinders		hp
Grain threshers		hp
Hay cutters		hp
Hay balers		hp
Hay hoists		hp
Corn shellers		hp
Corn crackers		hp
Oat crushers		hp
Grain elevators		hp
Grain grinders		hp
Fanning mills		hp
Clover hullers		hp
Rice threshers		hp
Pea and bean hullers		hp
Huskers and shredders		hp
Clover cutters		hp
Root cutter		hp
Wood splitter		hp
Cord wood saw		hp
Concrete mixers		hp
Cider mills		hp
Cider presses		hp
Air compressor for spraying machines		hp
Bone grinders		hp
Electric incubators		hp
Electric brooders		hp
Horse groomers (vacuum system)		hp
Horse groomers (revolving system)		hp
Horse clippers		hp
Sheep shearers		hp

26— Farm Shop Applications

Grindstone		hp
Emery wheels		hp
Forge blowers		hp
Portable drills		hp
Wood saws		hp
Lathes		hp
Planers		hp
Glue pots		hp
Soldering irons		hp

27— Electric Vehicles

Number and size Pleasure..
Commercial ....

28—Total amount of current consumed by country districts
Light........................ kw-hr........................
Power........................ kw-hr........................

29—Monthly current consumed by country districts
Maximum........................ kw-hr........................
Minimum........................ kw-hr........................

30—Average annual current consumed per customer in country districts.
Light........................ kw-hr........................
Power........................ kw-hr........................

31— **RATES COUNTRY DISTRICT**

Light —maximum ....
minimum ....
Power—maximum ....
minimum ....
Cooking and heating—maximum..........................
minimum..........................

32—Send schedule of rates for all classes of consumers

33— **REMARKS**

Results obtained and best methods found in application of electricity for:
Irrigation
General farm utility

34—General sentiment of people in your locality towards use of electric power, and future possibilities of development in country districts.
35—What would you estimate will be your horse-power requirements for new business next year in country districts?
36—What steps are you taking to promote the use of electricity on the farm?
37—Does your company sell motors and other electrical appliances?
38—Do you install plants for consumers, and if so, what plan is followed?
39—What is your system of charging and payments for this work?
40—Do you favor direct connected installations for pumping purposes?
41—What types of pump—centrifugal, plunger or turbine, are used in your territory, and which do you find gives the best results?
42—What voltage do you favor for motors?
43—What efforts do you make to test the consumer's plant and show him how to improve his operating conditions?
44—What automatic protective device do you use in connection with pumping plants?
45—Do your country solicitors use automobiles?
46—If so, do you find it profitable?
47—If not, how do they get around?
48—What are you doing towards advertising electricity on the farm?
49—If you have booklets or other literature for general distribution, send samples.
50—Do you advertise in newspapers and magazines?
51—What steps are you taking to replace gas engines and on what basis do you make the exchange?

PACIFIC GAS AND ELECTRIC CO.

AGRICULTURAL POWER, GENERAL

For installations of 5 hp. and over and less than 30 hp.:
3 cents per kw-hr. for 1st 500 kw-hr. per month.
2½ " " " " next 500 " " "
2 " " " " next 2000 " " "
1½ " " " " all over 3000 " " "
Minimum charge $6.00 per hp. per year.

For installations of 30 hp. and over and less than 50 hp.:
2 cents per kw-hr. Minimum charge $6.00 per hp. per year.

For installations of 50 hp. and over and less than 100 hp.:
1½ cents per kw-hr. for all current consumed.
Minimum charge of $6.00 per hp. per year.

For installations of 100 hp. and over:
1¼ cents per kw-hr. Minimum charge $6.00 per hp. per year.

For installations of 100 hp. and over where the consumer expects to irrigate a large tract of land from one central plant:
1 cent per kw-hr. for all current consumed.
Minimum charge $12.00 per hp. per year.

PACIFIC GAS AND ELECTRIC CO.

AGRICULTURAL POWER, OPTIONAL

This schedule applies to installations of 5 hp. and over.

3.0	cents per kw-hr. if monthly consumption	is less than	30	kw-hr. per hp.		
2.9	" " " " " "	equals or exceeds	30	kw-hr. and is less than	40	kw-hr. per hp.
2.8	" " " " " "	" " "	40	" " " " "	52	" " "
2.7	" " " " " "	" " "	52	" " " " "	66	" " "
2.6	" " " " " "	" " "	66	" " " " "	82	" " "
2.5	" " " " " "	" " "	82	" " " " "	100	" " "
2.4	" " " " " "	" " "	100	" " " " "	120	" " "
2.3	" " " " " "	" " "	120	" " " " "	142	" " "
2.2	" " " " " "	" " "	142	" " " " "	166	" " "
2.1	" " " " " "	" " "	166	" " " " "	192	" " "
2.0	" " " " " "	" " "	192	" " " " "	220	" " "
1.9	" " " " " "	" " "	220	" " " " "	249	" " "
1.8	" " " " " "	" " "	249	" " " " "	280	" " "
1.7	" " " " " "	" " "	280	" " " " "	312	" " "
1.6	" " " " " "	" " "	312	" " " " "	346	" " "
1.5	" " " " " "	" " "	346	" " " " "	381	" " "
1.4	" " " " " "	" " "	381	" " " " "	418	" " "
1.3	" " " " " "	" " "	418	" " " " "	456	" " "
1.2	" " " " " "	" " "	456	" " " " "	496	" " "
1.1	" " " " " "	" " "	496	" " " " "	538	" " "
1.0	" " " " " "	" " "	538			

Minimum charge $6.00 per hp. per year

The above rate is given only providing the consumer will sign a contract for a term of years, the length of the term depending on the value of the business in proportion to the expenditure necessary to supply such consumer.

NORTHERN CALIFORNIA POWER CO.

(Rate fixed by Railroad Commission of California)

SEASONAL POWER RATES

Applicable to Small Rural Power

Class A.

Normal or irrigating season of six consecutive months.

Demand charge: $1.00 per hp. per month, plus energy charge, 1 cent per kw-hr.

Minimum bill: $2.50 per month, for not less than six (6) consecutive months each year.

Class B.

Short season of three consecutive months

Demand charge: $1.50 per hp. per month, plus energy charge, one (1) cent per kw-hr.

Minimum bill: $5.00 per month, for not less than three (3) consecutive months each year.

SAN JOAQUIN LIGHT AND POWER CO.

RATE SCHEDULE

IRRIGATION PLANTS

Period of Year	Daily Service	Rate
1 Jan. 1 to Dec. 31	24 hours	$50.00 per hp.
2 Jan. 1 to Dec. 31	Daylight hours	36.00 “ “
3 Feb. 1 to July 31	24 hours	31.20 “ “
4 Feb. 1 to July 31	Daylight hours	22.50 “ “
5 Mar. 1 to July 31	24 hours	27.75 “ “
6 Mar. 1 to July 31	Daylight hours	20.00 “ “
7 Apr. 1 to July 31	24 hours	25.00 “ “
8 Apr. 1 to July 31	Daylight hours	18.00 “ “
9 May 1 to July 31	24 hours	22.50 “ “
10 May 1 to July 31	Daylight hours	16.50 “ “
11 June 1 to July 31	24 hours	22.50 “ “
12 June 1 to July 31	Daylight hours	16.50 “ “
13 July 1 to July 31	24 hours	22.50 “ “
14 July 1 to July 31	Daylight hours	16.50 “ “
15 Aug., Sept. & Oct. following service stated in Sections 3 to 14.	24 hours during Aug. and Sept. Midnight to sundown during Oct.	2½ cents per kw-hr. Monthly minimum $1.00 per hp. installed.

The electricity to be paid for during the flat rate period of each year shall be based upon the maximum amount used at any time during that period. All contracts shall be for a term of five years.

RATE SCHEDULE FOR

Pumping plants where the entire acreage to be irrigated therefrom will not be fully planted until one or two years succeeding the date of installation of said plant.

	Period of Year	Rate	Monthly Minimum
16	12 months	2¼ cents per hp-hr.	$1.75 per installed hp.
17	9 “	2¼ “ “ “	2.00 “ “ “
18	8 “	2¼ “ “ “	2.00 “ “ “
19	7 “	2¼ “ “ “	2.00 “ “ “
20	6 “	2¼ “ “ “	2.25 “ “ “
21	5 “	2¼ “ “ “	2.25 “ “ “
22	4 “	2¼ “ “ “	2.25 “ “ “

The hours of each day the motor may be operated are as follows:

During January from 12:01 a.m. to 4:30 p.m.
“ February “ 12:01 “ “ 5:15 “
“ March continuously
“ April “
“ May “
“ June “
“ July “
“ August “
“ September “
“ October from 12:01 a.m. to 4:45 p.m.
“ November “ 12:01 “ “ 4:30 “
“ December “ 12:01 “ “ 4:30 “

The meter rate conditions shall continue for a term of one or two years and shall then be followed by those stated in any of sections, 1, 2, 3, 4, 5, 6, 7, or 8 for a further term of five years.

NORTHERN COLORADO POWER CO.

READINESS TO SERVE RATE

A A kilowatt-hour charge as follows:

For the first 2,000 kw-hr. delivered per mo. at 3.00 cents per kw-hr.
“ “ next 2,000 “ “ “ “ “ 2.75 “ “ “
“ “ next 5,000 “ “ “ “ “ 2.50 “ “ “
“ “ next 5,000 “ “ “ “ “ 2.25 “ “ “
“ all over 14,000 “ “ “ “ “ 2.00 “ “ “

B In addition thereto a net readiness to serve charge per month during the year as follows:

$1.00 per connected hp. for each of first 15 hp. connected.
.75 “ “ “ “ “ “ next 10 “ “
.50 “ “ “ “ “ “ next 25 “ “
.25 “ “ “ “ “ hp. exceeding 50 hp. connected.

STRAIGHT METER RATE

A—A minimum charge per month of $1 per connected hp. or its equivalent.

B A kilowatt-hour charge as follows:

For any portion of

The first 500 kw-hr. delivered per month at 5.00 cents per kw-hr.
“ next 500 “ “ “ “ “ 4.50 “ “ “
“ next 1000 “ “ “ “ “ 4.00 “ “ “
“ next 3000 “ “ “ “ “ 3.50 “ “ “
Over 5000 “ “ “ “ “ 3.00 “ “ “

THE TRUCKEE RIVER GENERAL ELECTRIC CO.

ELECTRIC RATE SCHEDULE

For Irrigation purposes:—Power not to be used between the hours of 6 to 11 p.m. daily and only during the months from April to Oct. inclusive of each year. Power to be supplied and metered at 220 volts or supplied at transmission voltage and metered on the low tension side of consumers' high tension transformers.
Term of contracts:—Not less than five (5) years.
Minimum:—$3.00 per season per rated horse-power of motors connected.
Rates as follows:

For first	5,000	kw-hr.	1.7	cents	per	kw-hr.
" next	5,000	"	1.5	"	"	"
" next	20,000	"	1.3	"	"	"
All excess over	30,000	"	1.2	"	"	"

In addition to the meter rate to pay 50 cents per month per rated horse-power of motors connected or on the rated installed capacity of the high tension transformers, figured in kilovolt amperes, if they exceed 150% of the rated capacity of the motors.

Discounts: 10% on the above rates where payments are made on or before the 15th of the month next following that for which bill is rendered.

MR. S. M. KENNEDY, Los Angeles: I had nothing to do with the preparation of this Report, gentlemen. It was handed to me in San Francisco last week as I passed through. Mr. Lloyd asked me to supplement this with a few remarks, giving some information regarding the use of electricity in rural districts in California. Perhaps there is no State in the Union where electricity is used in the suburban districts more than in California. The main cause for this is that for six months in the year in California we have practically no rain. Now, we must have some means of supplying the farming and rural communities with water, and, as a consequence, the principal load which we have is that for irrigating purposes. My company, which operates in Southern California, and covers a large territory, has, for many years past, extended distribution lines of a voltage of approximately 10,000, and these have been used primarily for supplying power to operate these many hundreds of pumping plants. This load is of a character very desirable for an electric company to consider. I cannot agree with this Committee that electricity in rural districts is especially connected with hydro-electric power. It is just as close to development by steam. The business is there and it can be obtained if we go after it. In running transmission lines through sparsely settled communities we have helped to build up these communities and made them profitable.

We have increased the value of the land, and we have increased the income of the ranches. By and by, the communities pick up in importance, population becomes more dense, and we have to change the method of distribution. Gradually the 10,000-volt line is replaced by a 2200-volt line. Then comes the opportunity for development. We can supply lighting and current for small power plants by putting in transformers and stepping the current down. This method permits the rancher to use motors around his shop, and to use electricity for the illumination of the house, barn and stables and for other purposes. This business is handled on the same basis and under the same rates as it is handled in the neighboring cities. Now, it costs more to do the business, but we have no desire to charge a higher rate for lighting five or ten miles outside of the city than we do in the city. We have got to figure on the power and we have got to figure on satisfying the people and serving the community properly. We argue that we must occasionally take the lean with the fat, when we reach out after business. At first it may not be profitable, but it will develop and become so.

The principal use of water for irrigation is for citrous fruits, oranges, lemons, walnuts, vegetables, and also for alfalfa. Now, this alfalfa crop is coming to be one of the largest and most profitable crops in Southern California for the rancher. It surprises me that with the number of automobiles in use, the demand for alfalfa keeps increasing and the price keeps going up. I recently called on one of our customers, about 20 miles from Los Angeles, and he pointed to 140 acres of alfalfa, the first crop grown on the soil. He was irrigating with a 75-hp. motor and lifting the water 80 feet. That stand of alfalfa was 2½ feet high and he told me that he expected this year to obtain 7 crops of an average of 2 ft. high, 2 tons to the acre, $13 per ton. I think he has a better business than the central-station man. We also give electric service in the rural districts and quite a large part of our business is supplying energy for operating lemon, orange and walnut packing houses. When you go into one of these ranch packing houses you see all sorts of machinery being operated by electricity—scrubbers, driers and packers—and back in another room you find that electricity operates box-making machinery. We also supply service to wineries for use in connection with the handling of grapes, the pressing, bottling, and so on. Service is also supplied to olive packing houses. This is just one feature of our rural business. The dairy farm is, of course, growing in importance, along with the alfalfa business. In the dairy farm, electricity is being used quite extensively. It is cleanly, it helps the rancher to keep his place clean and inviting, and it makes the visitor feel that the milk is sanitary and safe. They use electricity in such places for illumination; cow-sheds and yards are all lighted because much of the work is done at night. We operate different kinds of electrical apparatus in connection with the shops and the milk separators, and, in some cases, we have machines for milking the cows.

The greatest competitor we have in the out districts is the gas engine. You may ask why the gas engine is there at all. My answer is that the gas engine was there before the electric company's line extended into the territory. It was there before the electric companies were. We are aware of the value of all that and have little difficulty putting in motors for new installation business. But a man with a gas engine has to be talked into using electricity. He might say, "Well, I don't know anything about electricity and distillate is cheap. I know what this gas engine will do and I don't know anything about the other." The principal reason has been, however, that he has his money tied up in the gas engine. It is not a question of rates altogether, it is a question of investment. In most cases a man had a thousand dollars tied up in a gas engine, and he did not want to put another thousand into a motor and pumping equipment. We loaded our lines fully with that kind of business, but we found that there was still plenty of power to be obtained if we could get rid of the gas engines. Two or three years ago we came to the conclusion that the only way to eliminate them was to buy them up. Our salesman would go out and visit the rancher, show him the advantages of electric power, take him to neighboring plants operated electrically, and the man would probably be convinced, but he would say, "There is my engine. What shall I do with it?" We would induce him to put in the motor and hold on to the gas engine in the hope of being able to sell it. We would list the engine to sell for him. That was all right for some but it did not work in all cases. Most of them said, "There is the engine, and I cannot afford to have it standing there, and put more money into a motor." Last year we purchased gas engines to the amount of 7000 horse power. These purchases were made upon a basis of what we considered a safe price. In many cases a man would hold an engine pretty high, and we valued his engine according to the amount of his business. We could not establish a fixed rate per horse power for these engines because of their varying conditions and different makes, but we had no trouble in getting all the business we wanted last year. The business obtained was of such a character that we really could have afforded to scrap that pile of engines and forget it, but it was not necessary to do that. We organized a selling department, put an expert in charge of it, and opened up avenues for the sale of those engines. There are parts of California, of Arizona and New Mexico, where there is as yet no electric power, and in those places and others, we sold gas engines at prices about as good as we paid for them. The one thing we took care of was that none of them can be resold under our own lines. This year we shall purchase probably 10,000 horse power.

I want to say a word in conclusion, regarding the use of electricity in the out districts. It is a great developer of business, and the uses for the service constantly increase. We have had, in our State, a loud outcry for good roads; we have built good roads, and these are drawing people out at night and they all call for light. These lines we have been extending for variour purposes other than lighting, are now coming into a use we did not anticipate, and we are making contracts with counties and communities for rural lighting, which helps in increasing our income and very largely helps in increasing the use of electricity in general.

A MEMBER: What is the price of gasoline and what is the price of current?

MR. KENNEDY: Distillate costs six to eight cents per gallon, depending on the locality. For ordinary irrigation for six months' business (each year), for the small installations, 5 to 25 horse power, we give a rate of 2½ cents per kw-hr. In the cases where the operation is for 12 months each year, the rate is less. The rate goes down to as low as one cent per kw-hr., depending upon the size of installation, hours of use, and load-factor conditions.

THE CHAIRMAN: The third section of this comprehensive report, that covering the Central States, will now be presented by Mr. C. W. PenDell, of Chicago, Chairman of the Sub-Committee.

REPORT OF THE COMMITTEE ON ELECTRICITY IN RURAL DISTRICTS

CENTRAL STATES

At the last two annual Conventions very valuable reports have been presented upon the subject of "Electricity in Rural Districts," extensive discussions have been had and great interest has been awakened in this very important branch of the central station industry. Following the first report, the National Electric Light Association officially took the subject up with the Department of Agriculture of the United States Government and interested them in it as being one of material importance to agriculturists, tending both to reduce the cost of their products and improve the general living conditions on a farm. Since the second report the subject has been agitated considerably and there is now a bill before the House of Representatives calling for the establishment of a bureau to collect and promulgate information concerning the use of power-driven machinery on the farm.

The two previous Committees have collected and tabulated considerable data on such farm machines as may be driven by electric motors; the subject has also been covered by numerous booklets and pamphlets published by the larger manufacturers of electrical apparatus.

The Executive Committee of the Commercial Section has realized that the subject of electricity on the farm is one which takes on considerable local color due to the diversified nature of the rural districts served by central-station companies in different parts of the country. They have, therefore, this year, divided the general Committee on the subject into three sections: one covering the territory of the Western States, one covering the Eastern States and this Committee, covering the Central States.

In the report of the first Committee, mention was made of the fact, that, besides the subject of the farmer's business itself, there was the question, important to the central station, of how this business could be served. And every central station that has entered into a campaign for rural business has soon come face to face with the fact that the question of how to serve this business is one of extreme importance.

The Committee for the Central States, knowing something of the territories covered by the Committees of the East and West, and surmising that the reports of the other two Committees must, of necessity, follow somewhat the lines of past reports, has formulated two opinions:

(1) The income from farming business alone, as developed in the Central States at present, does not, as a rule, justify the expense necessarily incurred in securing the business;

(2) Some reason, other than the farming business, must for the present be found for extending lines across the country, and the farm business picked up along the line as a by-product;

and divided its report into three sections, to wit:

Section I—The compilation of such data on "farming business" as the members of the Committee had available;

Section II—The central-station company's excuse for extending its distribution lines into sparsely settled districts;

Section III—Certain information and data as to how the rural business can be handled, giving a few estimates, and descriptions of lines, out-of-door substations, etc.

Because of the magnitude of the industries and subjects considered under Sections II and III, no attempt has been made to cover fully the subjects dealt with, but a brief sketch of each has been compiled to show its existence and importance, and it is hoped that the interest awakened by these partial presentations will lead to further reports on the individual industries mentioned.

The matter under Section III—rural lines and distribution—should probably more properly come up before the Technical Section of the Association, but the Committee has certain data available which it is thought may be of interest and value if included here. The Committee presents the following three sections of its report.

SECTION I

THE FARMER'S LOAD—ITS MACHINERY, REQUIRED POWER AND ELECTRICAL CONSUMPTION

"Electricity on the Farm" has attracted the attention of central-station companies during the past year more than ever before; it has been accorded more careful consideration as a serious problem and, as the possibilties of rural extension become generally known, interest in the subject is becoming widespread and personal.

As indicated in past reports of this Committee, progress in "farm business" has been the result of individual effort and made up of numerous isolated installations. An outline of the general situation and the fundamental reasons which have given stimulus to this new movement are fully set forth in the report of last year's Committee. This year's report, as far as the "farm load" is concerned, will lack novelty and will consist principally of reiteration and amplification along the lines previously followed.

A belief is prevalent and often justified in the Middle and Eastern States that it will not pay the central-station operator to make long and costly transmission line extensions solely for the purpose of securing a scattered farm load. Assuming that this is true, it is equally true that a farming load will pay, as a "by-product" if you please, when such extensions already exist or are being made to take care of other classes of business. The country is rapidly being covered by a network of transmission and distribution lines reaching out from a central point to small communities, and incidentally furnishing power for many other purposes along the way. Another part of this report will deal with other rural power applications, not coming under "the farm load" classification.

The recent development of low cost long distance switching and protective apparatus makes it possible to tap transmission lines for incidental loads, even where these loads are relatively small. A detailed description of this switching apparatus is included as a part of this report.

The following facts should be borne in mind by the central-station operator who contemplates rural extension:

(1) The electrical industry is less than 35 years old. It has been built up from nothing to one of the most important factors in our national industry.

(2) Very few central-station companies were able to earn the interest on the investment during the early days of the electrical industry. They have been built up from non-paying properties to profitable investments.

(3) Broadly speaking, the use of electricity has heretofore been confined almost exclusively to centers of population; but our cities, towns and villages have been so thoroughly exploited that it now becomes necessary to branch out into other fields if we are to expand. The rural load is forcing itself upon us.

(4) The rural load may not pay much at first. Past experience shows that we cannot expect it to pay dividends from the start, but if forethought and energy are devoted to building up this load, the results will eventually be commensurate with the present urban load. We should be able to develop a rural load with less effort than was required to build up the urban load.

(5) At the present time more interest is being shown in scientific agriculture than ever before in the history of the country. One has but to read the papers to know the progress that is being made. The establishment of farmers' co-operative and credit associations, institutes, granges and clubs; the establishment of experimental stations and the introduction of county demonstrators, all tend to simplify the problem by educating the farmer to the use of modern methods.

Electricity is the cheapest and most flexible form of energy known. When the farmer is brought to a realization of this fact—and he is rapidly reaching that point—he will use enough energy to warrant supplying it to him.

(6) The central-station operator can materially assist the education along these lines and at the same time profit by his efforts, if he will devote a reasonable amount of time to a study of the situation; pick a favorable locality and install a model plant for the specific demonstration of what can be done on the farm.

(7) A comprehensive list of farm applications is included in this report. The examples cited show what may be expected. These examples can easily be altered to meet local conditions.

(8) It is a mistake to agitate for the use of electricity in rural districts until the central-station operator is prepared to meet the demands for energy that may arise.

(9) Curves showing operating costs and load factors, income returns and the sizes of motors best adapted to various needs are also included in this report, simply as an indication of what may be expected from rural extensions. Corrections will have to be made to suit local conditions.

(10) Form the habit of capitalizing the future. Do not abandon a prospect because it will not show immediate profit. Do not exploit a proposition unless you can see a reasonable prospect of future returns. Say to yourself, "A new idea shall neither terrify nor fascinate me."

The following tabulations and curves represents the result of tests on actual and practical installations from data furnished by central-station and manufacturing companies, and are presented as models for the guidance of those who wish to conduct similar operations either experimentally or on a large scale.

In the calculation of all operating costs given below a uniform rate of 5 cents per kw-hr. has been adopted for power; but as the kilowatt-hours used for each unit of work are given, another power rate can easily be substituted in each individual case. Depreciation is charged at 10 per cent and interest at 6 per cent.

Too often the farmer loses sight of the fact that it costs him anywhere from 1 to 6 cents a bushel to haul his grain to and from the mill, depending upon the distance. A team of horses, under average conditions, will not travel faster than 2¼ miles per hour with a heavy load, say 54 bushels of shelled corn, 80 bushels of oats, or 43 bushels of ear corn. It will require at least one hour to load the wagon at the farm, unload and reload at the mill, and then unload the ground feed at the farm. A man and team are worth on an average $3.50 a day. Taking the above figures as a basis the following table shows the cost of hauling grain to and from the mill.

COST PER BUSHEL FOR HAULING TO AND FROM THE MILL

Distance in miles from farm to mill	Corn (shelled) Cents	Corn on ear Cents	Oats Cents
1	1.22	1.54	0.83
2	1.8	2.26	1.21
3	2.38	2.99	1.6
4	2.96	3.71	2.0
5	3.53	4.45	2.39
6	4.1	5.15	2.77
7	4.7	5.9	3.16

IRRIGATION

Water is a necessity for the growth of every crop. In the Western States, the rainfall is, as a rule, insufficient to support even a scant growth of vegetation, but in the Central and Eastern States the average rainfall during the growing season is ordinarily sufficient. However, in the latter sections of the country hardly a year passes without some particular section being badly in need of rain.

As rains, to be beneficial, must come at such times and in such amounts as will properly moisten the soil and produce growth, a check in this supply of soil moisture at any stage of growth affects both the quality and quantity of the yield and may greatly reduce the profits of the grower. The real test of the necessity of irrigation is not the total annual rainfall, but the monthly, and, in the case of most crops, the weekly amount of precipitation during the growing season. Under average conditions it is safe to say that a drought occurs whenever the rainfall totals less than one inch in any 15-day period, and crops will usually suffer if they do not receive more than this amount of rain, especially during the spring and early summer months.

The following table compiled from the rainfall records of the Weather Bureau, taken at respective points in the humid regions during ten growing seasons, 1900 to 1909, inclusive, shows the average and annual rainfall, the number of periods of 15 days in the ten years that droughts extended beyond the 15-day periods.

	Average Annual rainfall in inches	Number of 15-day periods or over with less than 1 in. of rain	*Number of days when irrigation was required
Ames, Iowa	30.39	23	190
Oshkosh, Wis.	29.78	27	292
Vineland, N. J.......	47.47	46	352
Columbia, S. C.....	47.55	62	568
Selma, Ala.	50.75	60	724

TABLE SHOWING THE AMOUNT OF CURRENT USED BY THE AVERAGE FARMER IN THE CENTRAL STATES

The Eureka Public Service Co.

This is mostly a lighting and small motor load. A typical farming country, no motor on the line over 5 hp. Has about 20 miles of line supplying small towns. Figures taken for 1911; since that time a large number of farmers have signed up for electric service.

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*No days counted until after a 15-day period with less than 1 inch of rain.

Public Service Co. of Northern Illinois

Figures taken for 1911; would now estimate that they have 150 farmers on their lines. This is mostly dairy farming and the installations consist to a large extent of pumping, lighting and refrigeration.

Aurora, Elgin and Chicago Railroad

Another type of dairy farm load where very little pumping and refrigeration are done; motors used mostly to run the ensilage cutters, fodder shredders and feed grinders during the winter months.

Rochester Railway & Light Co.

Typical truck garden load, installations consisting of motors for pumping and electric light. Figures for 1911.

Rochester Railway & Light Co.

1912 figures for all the farmers using electric light. One hundred and fifty-seven farmers now using electricity.

Elmwood Electric Light Co.

Typical farm lighting load, very few motors on the lines at the time these figures were secured. Figures for 1911.

Maryville Electric Light & Power Co., Maryville, Mo.

Two of these installations are large stock farms, namely: The Bellows Brothers, well-known shorthorn cattle breeders. The third is a dairy installation.

ELECTRIC CURRENT USED BY THE AVERAGE FARMER IN THE CENTRAL STATES

Company	No. of farmers Served	Electricity used mostly for	Aver. size of installation per farm in kws.			Aver. monthly consumption per farm in kw-hrs.	Kw-hrs. used per month per kw. of installation
			Lights	Power	Total		
Eureka Public Service Co.	41	Lamps and small motors	1.70	.94	2.64	41.7	15.8
Public Service Co. of Northern Illinois	31	Pumping, lighting and refrigeration	2.10	4.65	6.75	213.0	31.6
Aurora, Elgin & Chicago R.R. Co.	31	Large motors ...	.58	10.00	10.58	98.0	9.3
Rochester Ry. & Light Co.	60	Pumping and lighting	.73	1.34	2.07	39.5	19.1
Rochester Ry. & Light Co.	157	Lighting, pumping and power	.64	.87	1.51	38.2	25.4
Elmwood Elec. Light Co.	41	Lamps and small motors	1.25	.07	1.32	19.3	14.6
Maryville Elec. Light & Power Co.	3	Power and lamps	1.00	16.5	17.50	529.0	30.2

FIFTY USES FOR ELECTRICITY IN THE HOME

Lighting
Electric fan
Sewing machine
Electric iron
Washing machine
Wringer
Mangle
Pumps for water supply
Vacuum cleaner
Radiant toaster
Tea kettle
Coffee percolator
Chafing dish
Radiant grill
Baby milk warmer
Waffle iron
Hot plate
Frying pan
Griddle iron
Broiler
Soup kettle
Cereal cooker
Egg boiler
Egg beater
Corn popper
Water heater
Stove
Oven
Electric range
Fireless cooker
Meat grinder
Sausage stuffer
Coffee grinder
Bread mixer
Vegetable peeler
Plate warmer
Heating pad
Curling iron
Shaving mug
Cigar lighter
Sealing wax heater
Refrigeration
Ice crusher
Ice cream freezer
Buffer and grinder
Furnace blower
Foot warmer
Luminous radiator
Air heater
Ozonator

SIZE OF MOTORS TO USE ON DIFFERENT HOUSEHOLD MACHINES

	HP. OF MOTOR		
Machine	Min.	Max.	Size most commonly used
Sewing machine			1/30
Buffer and grinder	1/40	1/30	Both
Vacuum cleaner	1/8	5	1/8 to 1/4
Ice cream freezer	1/8	1/4	1/8
Washing machine	1/8	2	1/8 to 1/4
Meat grinder	1/4	3/4	1/4
Water pump	1/4	1	1/2

TWENTY USES FOR ELECTRICITY IN THE DAIRY

Cream separators
Water pumps
Churns
Butter workers
Butter cutting and printing machines
Lighting
Refrigeration
Milking machines
Milk cooling circulating pumps
Bottle washers
Cream testers
Milk clarifiers
Cream ripeners
Milk mixers
Butter tampers
Milk shakers
Curd grinders
Casein grinders
Pasteurizers
Ice breakers

SIZE OF MOTORS TO USE ON DIFFERENT DAIRY MACHINES

	HP. OF MOTOR		
Machine	Min.	Max.	Size most commonly used on average farm
Water pump	1/2	5	3
Cream separator	1/10	1/4	1/8
Churn	1/8	3	1/4
Milking machine (vacuum system)	2	3	3
Refrigeration	1/2	10	3

TWELVE USES FOR ELECTRICITY IN THE FARM SHOP

Grindstones
Leather burnishers
Emery wheels
Wood saws
Hack saws
Drills
Forge blowers
Drop hammers
Soldering irons
Glue pots
Lathes
Planers

SIZE OF MOTORS TO USE ON DIFFERENT FARM MACHINES

	HP. OF MOTOR		
Machine	Min.	Max.	Size most commonly used
Grindstone	1/8	1/4	1/4
Emery wheel	1/4	1	1/4
Lathes	1/4	1/2	1/2
Drills			
Forge blowers	1/15	1/8	1/10

THIRTY APPLICATIONS FOR ELECTRIC DRIVE FOR BARN AND FIELD MACHINERY

Water pumps
Feed grinders
Corn shellers
Ensilage cutters
Fanning mills
Cord wood saws
Grain elevators
Huskers and shredders
Corn crackers
Oat crushers
Alfalfa mills
Concrete mixers
Horse groomers
Horse clippers
Sheep shearers
Grain threshers
Hay cutters
Grain graders
Root cutters
Bone grinders
Hay hoists
Hay balers
Clover hullers
Rice threshers
Pea and bean hullers
Cider mills
Cider presses
Spraying machines
Clover cutters
Wood splitters

SIZE OF MOTORS TO USE ON THE DIFFERENT FARM MACHINES

	HP. OF MOTOR		
Machine	Min.	Max.	Size most commonly used
Feed grinders (small)	3	10	5
Feed grinders (large)	10	30	15
Ensilage cutters	10	25	15–20
Shredders and huskers	10	20	15
Threshers, 19-in. cylinder	12	18	15
Threshers, 32-in. cylinder	30	50	40
Corn shellers, single hole	¾	1½	1
Power shellers	10	15	15
Fanning mills			¼
Grain graders			¼
Grain elevators	½	5	3
Concrete mixers	2	10	5
Groomer, vacuum system	1	3	2
Groomer, revolving system	1	2	1
Hay hoists	3	15	5
Root cutters	1	5	2
Cord wood saws	3	10	5
Wood splitters	1	4	2
Hay balers	3	10	7½
Oat crushers	2	10	5

In the operation of corn shellers, fanning mills, grain graders, etc., very little power is usually required, and a motor of small capacity will insure constant operating speed and can be readily handled in the form of a portable equipment, so that a single motor can be utilized to drive all machines of this class in the farm equipment.

A single-hole sheller with a sacker attachment when driven by a 1-hp. motor requires about 0.025 kw-hr. of electricity to shell a bushel of ear corn at a rate of 26 bushels per hour. Even with electric current at 10 cents per kw-hr. the power cost for this operation would only be ¼ of a cent per bushel. Fanning mills and grain graders require less power than corn shellers for operation and a ¼-hp. motor is usually of ample capacity for this service.

It has been found by test that a motor-driven grain elevator, capable of unloading a 25-bushel load of ear corn in three minutes, will elevate 45 bushels 19 ft. at a power cost of 1 cent, power being purchased at the rate of 10 cents per kw-hr. This does not include a horizontal carry at the top which would slightly increase the cost.

The common types of portable grain elevators require anywhere from 1.5 to 5 hp. to operate them, depending on the height of the lift, the length of the horizontal carry and the number of loads which can be disposed of in an hour.

ELECTRIC WASHING MACHINES

Cost of electric washing machine, $75.

Cost of hand washer, $25.

Average time required per washerful, 17 minutes.

Power consumed per washerful, 0.0616 kw-hr.

Labor, 10c. per hour.

Interest at 6% and depreciation at 10%.

The main features of the electric washer are that it eliminates practically all of the physical labor involved in washing and in addition the attendant can perform other household duties while the electric motor does the work.

How to Read the Curve:

Suppose a woman has 16 washers per week, then the depreciation and interest on the washer alone is shown by curve No. 5 as 0.45c. per washerful. If the work is done by hand it will cost about 2.75c. per washerful for labor alone. When this is added to curve No. 5 we get curve No. 3, showing the total cost by hand 3.25c. Curve No. 4 shows the depreciation and interest on the electric machine or about 1.45c. per washerful. Then curves No. 2 and No. 1 show the total cost by electric power at 5 and 10c. respectively. If 10c. is used the total cost is 2.5c. per washerful. This shows a saving of 0.75c. per washerful.

CREAM SEPARATORS

In this case two sets of curves have been drawn, one for a machine having a capacity of 1100 lb. per hour, and the other for a 500-lb. separator. The larger machine costs but little more and will separate twice as much in the same time. The separating cost is only slightly above that of the 500-lb. outfit. Where time is an important item this small cost is immaterial.

(1) Capacity of machine, 1100 lb. per hour.
Cost of machine, $100.
Cost of motor equipment, $45.
Interest at 6%, depreciation 10%.
Power required to separate 100 lb. of milk, 0.0068 kw-hr.
Labor, 15c. per hour.

(2) Capacity of machine, 500 lb. per hour.
Cost of machine, $75.
Cost of motor equipment, $45.
Interest at 6%, depreciation at 10%.

How to Read the Curve:

If a farmer has 800 lb. of milk to separate per day, curve No. 4 shows the depreciation and interest on the machine alone amounting to 0.4c. per 100 lb. The labor is added to this curve when the work is done by hand and shown by curve No. 1, or 1.87c. per 100 lb. Curve No. 5 shows the depreciation and interest on the motor and machine as 0.78c. per 100 lb. and the total cost with power at 10c. is shown by curve No. 2 as 1.45c. per 100 lb. Hence a saving of 0.43c. per 100 lb.

The figures on the larger machines can be determined in the same way.

MILKING MACHINES

(VACUUM TYPE)

Cost of 3-hp. single-phase motor, vacuum pump and 2 machines, $450.

Each additional machine, $75.
Interest 6%, depreciation 10%.
Labor, 15c. per hour.
Power required for each cow, 0.019 kw-hr.
Eight machines will milk about 90 cows per hour.

HAND MILKING

Assume that each man can milk 10 cows per hour.

It has been found by experiment that the 4 and 10-machine equipments require about the same amount of power to drive them. This will hold true unless the speed of the vacuum pump is reduced when using the smaller number of machines. It is but the question of how many cows the farmer milks and how quickly he wants them milked that decides how many machines to use.

How to Read the Curve:

If a farmer has 150 cows in the herd there is no investment in machines if the milking is done by hand, hence the straight line curve shows the labor as 1.57c. per cow per milking. If the farmer has 10 machines the depreciation and interest on the set will amount to 0.16c. per cow as shown on curve No. 5. With power at 10c. curve No. 2 shows the total cost at 1.14c. per cow, with a saving of 0.4c. per cow per milking.

MILKING MACHINE

Machine

Name, B. L. K. No. 4.
Capacity, 10 machines; 20 cows at one time.
Made by, D. H. Burrell & Co., Little Falls, N. Y.
Speed of pump, 390 rev. per min.
Cost, complete, $900, including cans, etc.

Note: Only eight machines, milking 16 cows at a time, were used during this test.

Motor, 3 hp., 220 volt, 19 ampere, B. A., Wagner, 1750 rev. per min., belted.

POWER REQUIRED TO OPERATE

Motor and machine loaded...	Steady	Ave. hp. 2.3
Amount of work done	90 cows milked	432 qts. milk
Time	59 minutes	
Kw-hrs. used	1.715	
Kw-hrs. to milk one cow	.019	

OPERATING COST

Cost of complete equipment	$900
Interest on $900 at 6%	54
Depreciation on $900 at 10%	90
Total interest and depreciation	$144

Machine used 718 hrs. per year, milking 65,700 cows.

.019 kw-hr. at 5 cents	$0.001
Depreciation and interest	.0022
5 men at 15 cents per hr.	.0084
Cost of milking 1 cow	$0.0116

NOTE—This machine has replaced six men, and the owner is authority for the statement that he saved enough in labor cost in eleven months to pay for the equipment, or about $82 per month.

ENSILAGE CUTTERS

Cost of machine, $185.

Cost of 10-hp. small phase motor, $260.

Cost of 15-hp. single-phase motor, $390.

Interest at 6% and depreciation at 10%.

Cost per day of hiring a custom machine:

$10.00	engine, machine and engineer
4.50	2000 lb. of coal
1.00	hauling coal
1.50	extra man
1.00	feed for extra man.
$18.00	total cost.

Machine cuts 90 tons per day.

Power consumed per ton, 1.38 kw-hr.

In this curve the depreciation and interest on the motor are a large factor. If the motor is used for other purposes the results of the total cost curve would be lowered considerably. The motors too, are single-phase, which materially increases both the first cost and the operating cost.

How to Read the Curves:

If a farmer had 800 tons of ensilage to cut, the depreciation and interest on the cutter would amount to 3.6c. per ton shown on curve No. 7. Suppose he used a 10-hp. motor then curve No. 6 would show the depreciation and interest on the motor and cutter or 5.1c. per ton. With power at 10c. the total cost is shown by curve No. 3 as 15.6c. per ton. The cost of custom cutting is shown as 20c. per ton, hence a saving of 4.4c. per ton. If a 15-hp. motor is used a similar method of determination can be used.

ENSILAGE CUTTER

Material	Tons cut	Time in min.	Rate per hr. in tons	Total kw. hr.	Kw. hrs. per ton	Tons per kw. hr.	Max. hp	Min. hp	Average hp
Motor and machine, empty .		2.		.1735					7.
Motor and machine. loaded green corn	.99	10.35	5.74	1.465	1.48	.675	15.6	7.7	11.36

CORN SHELLING

Machine

Name, "Favorite."

Capacity, 26.5 bushels of flint corn per hour.

Made by, Marseilles Co., East Moline, Ill.; speed, 280 rev. per min.; cost, machine $35; motor $75.

Motor, 1 hp., 220 volt, RI., 1800 rev. per min., General Electric Co., belted to shaft.

POWER REQUIRED TO OPERATE		Average hp.
Motor		.43
Motor and shaft		.52
Motor, shaft and machine (empty)		.64
Motor, shaft and machine (loaded)		.98
Amount of work done, bu.	2.2	
Time, min.	5	
Kw-hr. used	.061	
Kw-hr. to shell one bu.	.0278	
Bu. per kw-hr.	36	

CORN SHELLING

Cost of machine, $35.

Cost of ½-hp. single-phase motor, $73.

Interest 6%, depreciation 10%.

Labor, 15c. per hour.

Rate of shelling, 114 bu. per hour.

Power required per bu., 0.0448 kw-hr.

Requires one man in attendance with electric power, and two men with hand power.

These curves are drawn considering that the motor is used for this purpose alone and the cost per bushel would be greatly reduced if the motor were used for other operations. This machine is a little small for the size of the motor.

How to Read the Curve:

If a farmer has 2000 bushels of corn to shell per year, curve No. 6 shows the depreciation and interest on the machine to be 0.3c. per bu. Adding to this the labor of two men we get on curve No. 1, 2.1c. per bu. as the total cost of operating the hand sheller.

With electric power the depreciation and interest on the machine and motor are shown by curve No. 4 as 0.9c. per bu.; adding the power cost to this gives curves No. 3 and No. 2, which with power at 3 and 10c. respectively gives a total cost of 1.48c. and 1.8c.

CORN SHELLER

Operation	Work done in bus.	Time in mins.	Rate per hr. in bus.	Total kw. hours	Kw. hrs. per bu.	Bu. per kw. hr.	Max. hp.	Min. hp.	Av. hp.
Motor alone		15		.080					.43
Motor and shafting		15		.097					.52
Motor and shafting sheller (empty)		15		.119					.64
Motor and shafting sheller (loaded)	2.2	5	26.4	.061	0.278	36.			.98

NOTE—No operating costs are included. as this equipment was tested at the Edison Electric Illg. Company's "Farm of Edison Light & Power," Boston, Mass.

CORN GRINDING

(Shelled)

Cost of grinder, $25.

Cost of 5-hp. single-phase motor, $160.

Depreciation at 10%, interest 6%. Depreciation could be figured as low as 7%.

Labor, 15c. per hour.

Rate of grinding, 12.6 bu. per hr.

Mill charge for grinding, 5c. per bu.

Kw-hrs. per bu., 0.433.

Power rates at 3c., 5c., 7c., 10c. per kw-hr.

The high electric costs are due to the depreciation and interest on the motor all being charged to this operation. If the motor were used for other purposes these costs would be greatly reduced.

Data of Hauling

Rate of travel, 2.25 miles per hour.

One hour for loading and unloading.

54 bushels hauled per load.

35c. per hour charged for man and team.

Labor of one man is charged up against the electrical power. The grain was ground as fine as it is ever used in farm practise, and therefore these figures may be considered the maximum for dry dent corn. The current consumption per bushel for flint corn will be somewhat greater, due to its extreme hardness.

How to Read the Curve:

Suppose a farmer has 2000 bushels of corn to grind, then the curve gives the depreciation and interest on the motor, or about 1.25c. per bu. Curve No. 5 gives the depreciation and interest on both the machine and motor, or 1.45c. per bu. Then if he pays 3c. per kw-hr. for power, curve No. 4 gives the total cost per bushel, or 3.95c. Likewise curves No. 3, No. 2 and No. 1 give the cost at the rates 5c., 7c., and 10c., respectively.

If the farmer lives one mile from the mill the total cost per bushel will be 6.2c., for the mill charge is 5c. and the cost of hauling is shown by the difference between the curves marked mill charge and 1 mile. The cost can be figured in the same way if he lives 2, 3, 4, 5 or 6 miles from the mill.

CORN GRINDING
(Ear)

Cost of grinder, $100.
Cost of 10-hp. single-phase motor, $260.
Interest 6%, depreciation 10%.
Labor, 15c. per hour.
Rate of grinding, 41 bu. per hr.
Power required per bu., 0.411 kw-hr.
Labor of one man charged up against electric power.
Power rates, 3c., 7c., 10c. per kw-hr.

Hauling

Rate of travel, 2.25 miles per hr.
One hour allowed for loading and unloading.
Bushels hauled per load, 43.
$3.50 per day charged for man and team.
Mill charge for grinding, 5c. per bu.

The electric costs would be greatly reduced if the motor were used for other purposes. The corn with which the test was made was quite dry. Damp or new corn might increase the current consumption per bushel as much as 50 per cent. However, in this test the grain was ground as fine as it is ever used in farm practise and therefore these figures may be considered the maximum for dry dent corn. The current consumption for flint corn will be higher than the figures given.

OAT CRUSHING

Cost of crusher with direct-connected motor, $300.
Labor at 15c. per hour.
Rate of crushing medium fine, 50.5 bu. per hr.
Power required per bu., 0.045 kw-hr.
Mill charge for grinding, 5c. per bu.

Notes on Hauling

Rate of hauling, 2.25 miles per hr.
One hour allowed for loading and unloading.
Bushels hauled per load, 80.
$3.50 per day for man and team, 10-hr. basis.

In these curves the motor has been used entirely for the one operation, hence the cost of using electrical power is high when small amounts only are crushed. If the motor is used a portion of the time on other machines a proper deduction can be made from the curve.

The labor of one man is included in the total cost by electric power. The same method of reading the curve can be followed, except that in this case the curve showing the depreciation and interest on the motor alone is omitted.

OAT CRUSHER

Machine

Name, Gibson special.
Capacity, 50 bu. oats, medium fine; 10.5 bu. extra fine.
Made by, Gibson Oat Crusher Co., Chicago, Ill.
Speed of rolls, 500 rev. per min.
Cost complete, including motor, $300.

Motor, 2 hp., 220 volts, 12.8 ampere, RI., General Electric Co., 1760 rev. per min., direct connected by gearing.

POWER REQUIRED TO OPERATE

		Average hp.
Motor and machine (empty)		1.02
Motor and machine (full load)		3.04
Amount of work done, bu., medium fine	9.23	
very fine	.88	
Time, min., medium fine	11	
very fine	5	
Kw-hr. used, medium fine	.416	
very fine	.161	
Kw-hr. per bu. of oats	.045	
Kw-hr. per bu. of oats, medium fine	.045	
very fine	.183	

OAT CRUSHER

Oprat on	Work done in bu.	Time in min.	Rate per hr. in bu.	Total kw. hr.	Kw. hr. per bu. of oats	Bu. per kw. hr.	Max. hp.	Min. hp	Average hp.
Crushing medium—									
Motor and crusher rolls together (empty)		10		.127			Steady		1.02
Crushing fine—									
Motor and crusher (loaded)	9.23	11	50.5	.416	.045	22.2	Steady		3.04
Motor and crusher rolls together (empty)		10		.179					1.44
Motor and crusher (loaded)	.88	5	10.5	.161	.183	5.5			2.6

Note—No operating costs are included as this equipment was tested at the Edison Electric Illg. Company's "Farm of Edison Light & Power," Boston, Mass. This machine could not be operated to its full capacity, due to the fact that the motor was not large enough.

ENSILAGE CUTTER

Name, Hocking Valley, No. 20.
Capacity, 5.74 tons of corn per hr.
Made by, Hocking Valley Mfg. Co., Lancaster, Ohio.
Speed of Pulley, 800 rev. per min.
Cost complete, $457.
Motor, 10 hp., 220 volt, 46 ampere, RI., General Electric Co., 1700 rev. per min., belted.

POWER REQUIRED TO OPERATE

		hp.
Motor and machine (empty)		7
Motor and machine (loaded)		11.6
Amount of work done, tons	.99	
Time, minutes	10.35	
Kw-hr. used	1.465	
Kw-hr. to cut one ton	1.48	
Rate in tons per hr.	5.74	

OPERATING COST

Cost of cutter		$175
Cost of motor (installed)		282
Depreciation on motor and cutter at 10%	$45.70	
Interest on motor and cutter at 6%	27.42	
Total interest and depreciation per year	$73.12	
Machine used 61 hrs. per year culling 350 tons of ensilage.		
1.48 kw-hr. per ton at 5c. per kw-hr.	$0.074	
Depreciation and interest	.209	
Labor—1 man 61 hrs. at 15c.	.026	
Cost per ton	$0.309	
Total cost per year	$108.00	

NOTE—The depreciation and interest charges are almost 68% of the total cost per ton. If two farmers, each having 350 tons of corn should buy such an equipment together, they could reduce the depreciation and interest charge to 10c. per ton and the total cost to 21c. per ton. The motor used was single-phase, which increased the first cost considerably.

ENSILAGE CUTTING

(RYE)

Machine

Name, Hocking Valley, No. 20.

Rating

Capacity, 2.6 tons of rye per hr.
Made by, Hocking Valley Mfg. Co., Lancaster, Ohio.
Speed of pulley, 800 rev. per min.
Cost, cutter $175; motor $282, installed.
Motor, 10 hp., 220 volt, 46 ampere, RI., General Electric Co., 1700 rev. per min., belted.

POWER REQUIRED TO OPERATE

		Average hp.
Motor and machine (empty)		9.4
Motor and machine (loaded)		11.3
Amount of work done, tons	1.18	
Time, minutes	27	
Kw-hr. used	3.8	
Kw-hr. to cut one ton	3.11	

NOTE—No operating costs are given, as the owner cut only a few tons in order to determine if it were feasible to use green rye for ensilage. The experiment was a success as the rye made excellent summer ensilage. This is a new field for the ensilage cutter, and an excellent central station load. Note the current consumed per ton—3.8 kw-hr., as against 1.48 kw-hr. per ton of corn.

CLOVER CUTTER

Name,

Capacity, 41 lb. of dry clover per hr.

Sold by, Ames Implement & Feed Co., Boston, Mass.

Cost, machine $10; motor $50.

Motor, ½ hp., 220 volt, RI., General Electric Co., 1800 rev. per min., belted through shafting.

POWER REQUIRED TO OPERATE

		Average hp.
Motor		.27
Motor and shafting		.386
Motor and shafting and machine (empty)		.425
Motor and shafting and machine (loaded)		.48
Amount of work done, lb.	20.5	
Time, minutes	30	
Kw-hr. used	.178	
Kw-hr. for 100 lb. of clover	.870	

CLOVER CUTTER

Operation	Work done in lb.	Time in min.	Rate per hr. in lb.	Total kw-hr.	Kw-hrs. per 100 lb.	Lb. per kw.	Max. hp.	Min. hp.	Average hp.
Motor alone		10		.0334					.27
Motor and shaft		10		.048					.386
Motor and shaft, cutter empty		10		.053					.425
Motor and shaft, cutter loaded	20.5	30		.178	.870	115.			.48

Note—No operating costs are included, as this equipment was tested at the Edison Electric Illg. Company's "Farm of Edison Light & Power," Boston, Mass.

SECTION II

SOME RURAL DISTRICT INDUSTRIES, THE INCOMES FROM WHICH WILL WARRANT LINE EXTENSIONS

The Committee feels that although the business outlined in Section I is of great importance, there are other industries in rural districts besides farming which are good sources of revenue and which have, thus far, been neglected. Among these sources of load for the central station are:

Irrigation and drainage projects
Sand and gravel plants
Coal mines
Stone quarries
Brick and tile works
Cement plants
Railway pumping plants
Railway signal installations
Ice harvesting
Sawmills
Excavating
Gold dredging
Country clubs
Institutional schools
Grist mills
Grain elevators
Creameries
Dairies

A majority of these industries might be made big consumers per horse power connected, and in almost all cases their loads should be secured on very satisfactory terms.

It is appreciated that central stations do not have all of these industries in their territory, but each company may have some of them, or still others as promising. The industries located in rural districts are usually heavy power consumers and will well repay careful study by the central station serving the region.

We give a few facts and figures on some of the above mentioned industries, which may be of interest to the men in the field upon whom falls the problem of securing similar business for their company.

IRRIGATION AND DRAINAGE

The problems under this head cover a range from one to several hundred horse power and each case has unlimited conditions which made it special. Each case must be considered from the angles of the amount of water to be handled per minute, per month and per year; minimum, average and maximum suction and total heads; types of pumps and motors to be used; types of motor control; conditions under which the equipment must be installed and maintained, etc. The salesman should have an accurate knowledge of the operating characteristics of deep-well plunger and turbine pumps, air lifts, triplex and centrifugal pumps, motors and special control apparatus.

STONE CRUSHING PLANT

This plant quarries and crushes stone of two kinds, a soft grade of cement rock and buckwheat stone containing considerable lime. The quarrying is done mostly by hand. Horse cars are employed to convey stone from the quarry to the crushers. There are 40 men employed, working 10 hours per day. Group drive.

The maximum capacity of this plant is 6000 tons per month; average output, 4000 tons.

Total connected load 67.5 hp., four motors installed; average consumption per month 3311 kw-hr.

The electrical energy consumption per ton of stone crushed is 0.75 kilowatt-hours.

KILOWATT-HOURS FOR 10 MONTHS

1912	Kw-hr.	1912	Kw-hr.	1912	Kw-hr.	1913	Kw-hr.
Apr.	1020	July	3690	Oct.	3930	Jan.	2520
May	3120	Aug.	5370	Nov.	5010		
June	4380	Sept.	3420	Dec.	660		

The installation of this plant consists of the following:

No.	Hp.	Speed R.P.M.	Application
1	40	1140	Belted to a Power & Mining Machinery Co. No. 4 McCully gyratory crusher, capacity 20 to 40 tons per hour. Pulley 28 by 12 in. From the driving shaft a belt runs to a drum mechanism which draws a 700-pound car up a 100-foot incline, a five-per-cent grade. Maximum load of car, 2400 lb.; average load, 1200 lb.
1	15	1120	Belted to a 3-hanger shaft and a 2-hanger countershaft, latter bevel-geared to lower end of a revolving screen, 15 ft. long by 2 ft. 4 in. diameter. Revolves at 32 r.p.m. Geared from the 3-hanger shaft is a 12 in. bucket elevator, 65-ft. lift.
1	5	1130	Belted to a short shaft driving a 20 in. horizontal belt conveyor about 35 ft. long. Belt designed to move in either direction.
1	7.5	1140	Belted to a 2-hanger shaft then geared to driving shaft at top of a 14 in. belt conveyor having a 30 deg. rise for 75 ft.

All motors are of the squirrel cage induction type.

STONE CRUSHING PLANT

Name	
State	Pennsylvania.
Business	Stone crushing.
Process	
Drive	Group and individual.

KILOWATT-HOURS FOR 8 MONTHS

1911	Kw-hr.	1912	Kw-hr.	1912	Kw-hr.		Kw-hr.
Oct.	5540	Mar.	3590	June	2670		
Nov.	4950	Apr.	4250	July	2060		
Dec.	1290	May	2620				

Total connected hp.	217
Total number motors installed	5
Average kw-hr. per month	3371
Average kw-hr. per month per connected hp.	

The installation of this plant consists of the following:

No.	Hp.	Speed R.P.M.	Application
1	75	850	Squirrel cage motor, belted to a No. 6 Gates, style K stone crusher.
1	100	850	Squirrel cage motor, belted to a 12.25 by 18.25 by 12 in. stroke, Ingersoll-Rand air compressor, running at 180 r.p.m. and supply air at 90 pounds pressure to the drills.
1	10	690	Belted to a 10-foot line shaft, driving one 12 foot by 3 foot revolving screen, running at 19 r.p.m. and one 16 by 10 by 8 in. bucket elevator, 50 ft. high.
2	16	...	Series wound motors operating a 10-ton Baldwin-Westinghouse locomotive used to haul five empty cars weighing one ton each up a 2-mile 5 per cent grade.

The energy consumption per ton of rock crushed is 0.34 kilowatt-hours.

The supply source is 2-phase, 60-cycle, 220-volt, and 600-volt, direct-current.

STONE CRUSHING PLANT

Name	Fort Smith Stone Quarry.
City–State	Fort Smith, Ark.
Business	Crushed stone.
Process	
Drive	Combination.

KILOWATT-HOURS FOR 11 MONTHS

1912	Kw-hr.	1912	Kw-hr.	1912	Kw-hr.	1912	Kw-hr.
Jan.	1200	Apr.	3800	July	4760	Oct.	3680
Feb.	1560	May	5480	Aug.	5400	Nov.	2280
Mar.	2040	June	5360	Sept.	6080		

Total connected hp.	100
Total number motors installed	3
Average kw-hr. per month	3785
Average kw-hr. per month per connected hp.	38

The installation of this plant consists of the following:

No.	Hp.	Speed R.P.M.	Application
1	50	900	Belted to a line shaft driving one Allis-Chalmers No. 4 gyratory crusher; one 60-ft. bucket conveyor; one 4-section 4-ft. screen; and one elevated link chain tramway.
1	25	900	Belted direct to Allis-Chalmers No. 2 gyratory crusher.
1	25	900	Belted direct to 6-in. centrifugal pump.

The supply source is 2-phase, 60-cycle, 220-volt.

STONE CRUSHING PLANT

Name	United States Crushed Stone Co.
City–State	McCook, Ill.
Business	Crushed stone and cement.
Process	
Drive	Group and individual.

KILOWATT-HOURS FOR 12 MONTHS

1912	Kw-hr.	1912	Kw-hr.	1912	Kw-hr.	1913	Kw-hr.
Feb.	86300	June	134400	Oct.	127100	Jan.	16200
Mar.	123000	July	110200	Nov.	86100		
Apr.	101700	Aug.	112100	Dec.	14200		
May	119900	Sept.	120000				

Total connected hp.	2189
Total number motors installed	26
Average kw-hr. per month	98.433
Average kw-hr. per month per connected hp.	

The average electrical energy consumption per cubic yard of output is 1.66 kilowatt-hours.

The installation of this plant consists of the following:

No.	Hp.	Speed R.P.M.	Application
2	10	1200	Slip-ring motors, operating 2 well drills.
1	150	600	Belted to 2-stage Ingersoll-Rand air compressor.
1	200	600	Belted to No. 8 crusher plant.
1	10	600	Belted to skip-tower feed rolls. This motor is controlled by a remote-control compensator.
1	30	900	Squirrel-cage motor, driving primary screen.
1	40	900	Slip-ring motor, driving No. 6 crusher.
1	20	900	Slip-ring motor, driving No. 4 crusher.
1	85	720	Belted to No. 9 conveyor and screens.
1	15	600	Belted to pan conveyor.
1	10	600	Belted to skip-tower feed rolls. This motor is controlled by a remote-control compensator.
1	30	900	Belted to primary screen.
1	40	900	Slip-ring motor, driving No. 6 crusher.
1	20	900	Slip-ring motor, driving No. 4 crusher.
1	300	600	Slip-ring motor, driving skip hoist.
1	300	600	Slip-ring motor, driving quarry hoist.
1	15	720	Driving upper feed roll.
1	15	720	Driving tower feed roll.
1	2	1300	Direct connected to oil pump.
1	52	720	Driving auxiliary hoist.
1	200	514	Driving plain roll.
1	250	514	Driving slugger roll.
1	300	600	Driving quarry hoist.
1	75	600	Centrifugal pump.
1	25	1200	Direct-connected to 4-in., 3-stage centrifugal fire pump.

All motors are polyphase induction machines, operating at 440-volt.

POWER REQUIRED BY STONE CRUSHER

(*Reprint from article in the Electric Review and Western Electrician.*)

The following data relative to power requirements of stone crushers may be of value to central station engineers figuring on quarry installations:

GATES GYRATORY CRUSHER

No.	Hp. required
4	14– 21
5	22– 30
6	28– 45
7½	50– 75
8	70–110
9	100–150

AUSTIN GYRATORY CRUSHER

No.	Hp. required
0	4– 5
1	8– 10
2	12– 15
3	20– 25
4	25– 30
5	30– 50
6	40– 60
7½	75–125
8	100–150

AUSTIN JAW CRUSHER

No.	Hp. required
2½	10
3	12
4	18

BLAKE ROCK CRUSHER

10 by 4	4
15 by 9	10
24 by 12	20
30 by 24	65

STEEL ROCK BREAKER

7.5 by 13	12
9 by 15	15
10.5 by 22	20–25
11 by 26	25

WILLIAMS CRUSHER

No.	Hp. required
1	30
2	40
3	60
4	80
5	100
6	150
8	300

SYMONS CRUSHER

No.	Hp. required
6	18– 25
5	22– 30
7½	50– 75
0	100–150

MCCULLY CRUSHER

No.	Hp. required
1	4– 6
2	6– 10
3	10– 15
4	12– 20
5	20– 25
6	25– 40
7½	45– 70
8	65–100
9	100–140
10	125–175
12	200–250

For further data on stone quarries and power required by stone crushing machinery, see National Electric Light Association, Commercial Section, 1911, Report of Power Committee and Electrical Salesman's Handbook, Class No. S28.

RAILWAY PUMPING PLANTS

At various points along the rights-of-way of steam railroads will be seen water tanks for locomotive water supply. The pumping plants for these tanks may not be immediately adjacent to the tanks, but they are somewhere, and it is usually a comparatively easy load for the central station to pick up. The pumpage at such a point is usually small and its cost with an isolated steam or gasoline plant high. The cost of labor to operate such plants is high also and the central station's stronghold is in making such plants automatic in their operation, requiring a visit from the division pump-man only an hour once or twice a week.

In making such plants automatic it must be remembered that reliability of equipment is of prime importance. The company's service may go down for an hour or two at almost any time, but the pumping equipment must not fail to operate as intended it shall. Remembering that reliability is almost the biggest feature of this service, the use of centrifugal pumps is not recommended because of their losing their priming at times. When water is to be taken from a source where a suction pump can be used, it is almost always advisable on this service, to use direct-geared triplex pumps, taking precaution to screen the suction pipe to prevent the entry of solid matter which would interfere with the proper working of pump valves. When deep-well pumps are used they should have double-acting working barrels; the pumps should be equipped with automatic force-feed oilers.

RAILWAY SIGNALING

During the last two years a new class of rural business has been developing and is now increasing, which has as yet hardly received proper attention from central-station companies, to wit: railway signaling.

There are two general types of railway signal installations which require electricity for their operation, namely, interlocking plants and automatic block signals. The load unit in both of these classes is small, but the consumption by automatic block signals per kilowatt of maximum demand is exceedingly high.

Interlocking Plants

A simple crossing between two simple track lines requires a twelve "function" interlocking plant. It is standard practise to operate such a plant from an 80-ampere-hour, 55-cell, 110-volt storage battery. One charge of the battery will operate a plant like this for a couple of weeks, but it is customary to charge the battery every week; the main reason for this being to allow plenty of time to start or repair the gasoline engine which is ordinarily used to drive the 1.5-kw. charging generator.

A 10-hp. motor driving a 6-kw. direct-current generator will supply all the current needed for a large interlocking plant. If the central station is content to take only the income from the battery at the interlocking, that is its misfortune. A close acquaintance with the Signal Engineer, Signal Supervisor and Division Repairman and a little educational work, will get the lighting load at the interlocking plant, and that will use many times the kilowatt-hours per month that will be used for battery charging. It is not common practise on all roads to use central-station service direct on the electric lights of signals, because of the danger of their going out at critical moments and the excessively low cost of burning oil lamps; but the installation of a proper lighting system will do away with the danger of outages and a sharp lead pencil will knock the low cost of the oil lamps into a cocked hat.

Automatic Block Signals

Automatic block signals on steam roads have been operated for years by means of gravity batteries. Highway crossing bells have been operated by Edison-Lalande batteries. On some roads the gravity and Edison batteries have been replaced by storage batteries and central charging stations have been located along the line; the partially exhausted batteries being replaced by fully charged cells at stated intervals and the discharged cells brought into the charging station for recharge. These charging stations are very desirable load for a central station.

When direct-current interurban lines became a factor in the transportation field it was necessary to develop a new system of automatic signaling for such lines. The rails form one of the most important circuits in automatic signaling. On a direct-current electric line the rails are used as one side of the power circuit, hence it became necessary to use alternating-current for the signal system in order that the rails might perform their double function of carrying both the power current and the signaling current, without the two systems or currents conflicting. On account of certain electrical conditions, a frequency of 25 cycles was originally used for the new signaling system.

The advent of the alternating-current, 25-cycle, single-phase railway required that a 60-cycle signaling system be developed.

The General Electric Co. was active in promoting 25-cycle signaling on both steam and direct-current electric roads and quite a lot of such equipment was installed. This company later sold its signal interests to the Union Switch & Signal Co., which had developed a 60-cycle signaling system and, upon purchasing the General Electric interests, relegated the 25-cycle system to the background and standardized the 60-cycle system. One of their ideas in promoting the 60-cycle system is that railroads can purchase such current at numerous points along their rights-of-way and thus not be required to invest capital in generating equipment.

A 60-cycle signaling system will require, depending upon how far apart the signals are placed, from ¼ to ½ kilowatt-hour per hour, at about 50 per cent power-factor, per mile of track. This load will be extremely constant, as the power-consuming units placed along the line are all very small. If a whole signal section is killed and then energized again, the "starting load" will be between ½ and 1 kilowatt, at 40 per cent power-factor, per mile of track and will last about 15 seconds.

Forty-four hundred or sixty-six hundred volts, single or 3-phase, have been generally adopted by the steam roads for distributing signal current along their lines. The central station delivers whatever voltage it has available at such points as service is desired by the railroad, and the railroad extends its signal line along its right-of-way. A transformer should always be interposed between the company's line and the railroad company's line; this is advisable even though the voltage of both lines is the same, on account of the complicated nature of the signal circuits and of possible troubles from grounds.

The railroad company's line is divided into sections from 15 to 30 miles long, according to the locations at which current can be purchased. The dividing point between sections is usually placed where current can be purchased and circuits are so arranged that each signal section can be fed from transformers at either end. There is being developed an automatic switching station which will switch a signal section of the railroad line onto the transformer at the other end of the line in the event of failure of service for any reason from the transformer carrying the load.

It must be remembered by central stations that failure of service on a signal system of this kind means delay for every train on the section at every signal during the time the current is off, and too frequent outages are sure to lose the business. Cost of current disappears to a great extent when considered against continuity of service. It is to promote continuity of service on the railroad company 4400-volt line that the above-mentioned automatic switching station is being developed. With such switching stations installed the transformers or services at both ends of a section would have to fail simultaneously before the railroad section of line would be without power.

HIGHWAY CROSSING GATES

While this load is more often urban than rural, it is thought that a few remarks on the subject may be of interest.

Electrically operated highway crossing gates have been developed within the last few years, the motors for which may be either alternating current or direct current. A ¼ or ½-hp. motor is applied to the mechanism of each gate and gates are usually placed in pairs. With electrical operation one man can control several sets of gates, limit of vision being usually about the only limitation, while with the old-style hand-air-pumped or mechanically operated gates comparatively few even closely located gates could be handled by one operator.

STONE QUARRIES

Stone quarries form a most desirable load for central-station service. Quarries are usually located not far from some small town; or, rather, a small town will usually spring up adjacent to a stone quarry of any considerable size.

In all except the very largest quarries the load is strictly a summer load, the quarry shutting down as soon as the ground is frozen. The machines to be driven are of a nature extremely adaptable to motor drive and the industry presents no absolute demands for steam in the process of manufacture. A requisite of prime importance in quarry practise is the flexibility of the source of power with motor drive. The frequently changing heads to which drainage pumps are subjected, the continual shifting in location of such pumps, the changing lengths and grades of hauls and inclines, the remodeling and extension of compressed-air pipe lines, the varying grades of stone encountered in the quarry and numerous other contingencies, make it often necessary to call upon the overload capacities of motors and machines and it is essential to have a safe margin in the capacities of motors selected for the various applications.

In the quarry proper the main operations consist of drilling, blasting, hauling and, where there is seepage of water into the quarry, pumping. From quarry the rock goes to crusher plant, where it is crushed and separated into the various sizes demanded by the trade.

The drilling of the rock preparatory to blasting in various quarries is done by four general types of drills, viz.: compressed-air tripod drills, making a 2 to 3-inch hole; well drills making a 4 to 6-inch hole; electric-air "pulsator" tripod drills for the same class of work as the compressed-air tripod drill and hand drills for placing "pot shots" in large size stone to break them up.

A compressed-air tripod drill requires about 150 cu-ft. of air at 90 lb. pressure at the drill for best operation. An electric-air "pulsator" drill has a small, specially constructed air-compressor as part of its equipment; the air-compressor is driven by a 7.5-hp. motor, the motor being started and stopped as the drill is operated or shut down. With both compressed-air and "pulsator" tripod drills the maximum efficient depth of hole is about 22 ft. and numerous changes in drill size are required as the hole deepens. The electric-air drill has a drilling capacity 25 per cent greater than a similar compressed-air drill and the power consumption of the electric-air drill is less than one-fourth that required by the compressed-air drill. The electric-air drill has not yet been very generally adopted in quarry practise because it is necessary to have the small motor-driven compressor located within 9 ft. of the drill proper and quarrymen are not fully educated to the advantages to be obtained by the use of the electric-air outfit.

Well-type drills are used in quarries where the working face is 40 to 100 ft. high. A series of 5 to 6-inch holes are drilled the full depth of face and 25,000 to 50,000 yards of rock loosened at one blast. Well drills are equipped with 10 or 15-hp. variable speed motors and have become very popular among quarrymen; their use not only improving quarrying conditions, but reducing the cost of power, labor and dynamite for drilling and blasting.

There will be needed around each quarry from two to six hand drills for drilling small holes for "pot shots." These drills require about 50 cu-ft. of air each and one or more of them will be in pretty steady use in the quarry.

The rock in quarry is loaded into cars of from two to ten yards' capacity, by hand or steam shovel, and then hauled to the crusher plant. The manner in which rock cars are transported from quarry to crusher plant depends upon local conditions. If the quarry is deep a system of inclines and drum hoists is employed; electric tramways are in use at numerous quarries and have been successful on grades as great as 6 per cent. There are two general types of motor-driven hoists for this work; one type uses a motor which runs continuously and the hoisting drums are controlled by friction clutches and band brakes; the other type has a variable-speed motor, direct-geared to the drum and the motor is started, stopped or reversed as desired. Either type of hoist is controlled by a man placed at the top of the hoist incline and the cars are usually self-dumping.

The rock cars dump their load into the main or largest crusher of the crusher plant, the size of which depends both upon the capacity of the plant and the method used in quarrying rock. The gyratory crusher is the most popular style of crusher, yet in some parts of the country Edison roll crushers are used to some extent, and jaw crushers are used considerably in plants having a capacity of less than 250 cu-yd. per day. Edison rolls and disc crushers are used to a great extent for crushing smaller sizes of rock.

From discharge openings at the base of the main crusher the rock drops into a bucket elevator which raises it to a rotary sizing screen. This screen separates the rock into various sizes and the various sizes are recrushed in smaller crushers or conveyed to bins, as desired. The details of the layout of a crusher plant will vary with each plant, but there will usually be three or four crushers, one or two bucket elevators, a couple of belt conveyors and from two to six screens in each plant.

Some crusher plants have a section in which small size stone is pulverized for use in fertilizer plants and potteries. Such a section will have its own equipment of pulverizers, tube mills, rotary dryers, conveyors, elevators, etc.

A combination of individual and group drive will be found most advantageous in crusher plants and the use of 440-volt motors will generally prove best. Crushers should be driven by slip-ring motors. If a crusher is shut down when it is full of rock it is often a troublesome job to clear it of all rock before starting up again, this is especially true if the crusher is driven by a squirrel-cage motor; if a slip-ring motor is used and the crusher belt is backed up a few feet by hand, the motor will often be able to start the crusher without its being necessary to clean out the rock. Dust-proof bearings should be used on all stone plant motors and it will usually pay to install all wiring in conduit.

As noted before, compressed-air will usually be required for drilling. Some air will almost invariably be needed, but the quarryman should know that each five cubic feet of air takes a horse power and the amount of air should be reduced to a minimum. Compressors should be equipped with some style of air governor to control the air delivery and pressure. The use of slip-ring motors is to be recommended for air compressor drive on account of the heavy starting load.

Some quarries are comparatively dry, while others will require the pumpage of several hundred gallons of water per minute, 24 hours per day. On account of there being at times considerable grit in the water pumped, the use of centrifugal pumps is usually best on this service; the use of the direct-connected centrifugal pump makes a pumping unit easy to move from point to point. The use of automatically controlled, slip-ring motors will be found to work out most satisfactorily for this service.

While the load demands of the different units of a quarry and crusher plant will fluctuate rapidly, the fluctuations will come in such a way that the demand upon a central-station line will be fairly uniform and under general conditions the load is a nice one to handle.

SAND AND GRAVEL PLANTS

Even more than is the case with stone quarries and brick plants, sand and gravel plants are practically always located at some distance from settlements of any size. Comparatively few men are required for the operation of even a large plant and the question of transportation of labor to and from the plant is seldom one of moment.

Plants having power-driven machines vary in size from one requiring 10 horse power to drive a short belt conveyor and dry screen, to plants requiring 300 or 400 horse power.

The power demand of such plants is more steady during time of operation than either stone quarries or brick plants and as no steam is required except in special cases for manufacturing purposes, central-station energy can be used to great advantage. The sand and gravel season closes as soon as the ground is frozen and all plants of the writer's knowledge shut down at dark, so that the load is strictly "off peak." Some attempt has been made to do dry screening in winter but with small success.

Motor drive and central-station service have been thoroughly tried out in this industry and the users will be found enthusiastic on the subject. The flexibility of motor drive is of great value here; putting individual motors on distant pumps and outlying belts dispenses with the operating troubles from long steam lines and long rope drives. On account of pumps being often of considerable size and located several hundred feet from the screening plant, the use of 440-volt motors will in general be found desirable.

Only plants taking gravel from dry ground are dealt with here; but there is another type of plant getting sand from river or lake bottoms by means of "sand-sucker" pumps, which make equally desirable load for the central station.

Fig. 23 shows a small plant in the lumber region of Louisiana. This small plant consists merely of an 18-in. 140-ft. centers, belt conveyor, a 72-in. diameter screen and a wash pump; all driven by a single motor with rope drive.

As a rule, in plants of any considerable size, 400 cu-yd. and over, the sand and gravel are loaded from the bank into small cars by a steam or electric shovel. Central stations should be cautious in recommending the use of, or of taking on, electric shovels in this class of work, as their load is of a very fluctuating nature and may cause considerable disturbance on transmission lines. The local lines to such shovels are also of a very temporary nature and are subject to short circuits.

Fig. 24 shows a 70-ton steam shovel with boom extended and bottom of bucket open after having dumped its load. Fig. 25 shows another style of bucket, a clam-shell, dumping its burden into the hopper at the loading end of a long conveyor.

The shovel often works several hundred or even thousand feet from the main gravel plant, and cars loaded by the shovel are hauled to and over the hopper at the loading end of the main conveyor belt by means of a steam "dinkey" engine, electric locomotive or a stationary car pulley such as is shown at the left of the plant in Fig. 26. The motors on such car pullers, or hoists, vary between 15 and 75 hp., depending on the size of cars, length of run, speed of cars and rise of incline.

From the hopper the sand and gravel are usually carried to the top of the screening and crushing plant by a long endless belt-conveyor. Fig. 27 shows the details of such a conveyor with its rollers concaving the belt to hold the load in place. The horse power required by such belts varies greatly under different conditions. In some cases the sand and gravel are raised to the top of the screening plant by a bucket elevator, as is shown in Fig. 28.

At the top of the screening plant the sand and gravel are dumped into the first screen. As they go into this screen they come into contact with a large stream of water, 250 to 1500 gallons per minute. The water washes such of the material as will go through the holes of the screen into a sluiceway which leads to the second screen. Such gravel as is too large to go through the screen drops out at the end of the screen and is chuted to a crusher, where it is crushed and returned to the main conveyor. The number of screenings and crushings the sand and gravel go through depends upon the class of material handled and the market served by the plant.

Fig. 28 shows a small plant with three revolving screens, one stationary screen and a single crusher. Unless such a plant were very heavily loaded, a 50-hp. motor would handle the load nicely and a 15-hp. motor would probably take care of the water supply.

Fig. 26 shows a plant of considerably larger capacity than the average plant. There are two screening towers in this plant. In the first tower there is a single screen and the large-sized gravel is removed by "dry screening" before the sand and gravel are sent to the "wet screens." The chutes taking gravel to the crusher at the base of first tower can be seen, as can the auxiliary conveyor taking crushed gravel back onto the main conveyor. In the wet screen tower can be seen twelve screens, operating in pairs.

EXCAVATING OR CANAL DIGGING

In districts where irrigation or drainage projects require the digging of large canals there is another source of revenue from rural business. Contractors on this class of work are usually in a hurry and want equipment which will be subject to the least delay required by repairs. Where the ground is not too hard and dirt taken out of the canal is to be deposited along the bank, the drag line excavator has been found to be a highly efficient machine.

We have stated before in our report that care should be exercised in taking on electric shovel loads because of their extreme fluctuations. We referred to the type of shovel that picks its load up from underneath. (See Fig. 26) This criticism does not hold for the drag-line type of excavators or shovels having clam-shell buckets, which dig down into their load. The drag-line type of excavator has not these severe fluctuations and is not only a highly desirable load for a cross-country transmission line, but can dig the ground out from under its steam competitor.

Fig. 29 shows the electrically operated drag-line excavator which loads cars for the sand and gravel plant in Fig. 26.

In this type of machine the large drag-line motor usually runs continuously and the lines are controlled by means of friction clutches on the winding drums; the motor which turns the excavator to swing the boom running when it is desired to swing. The friction clutches require considerable pressure and are operated by compressed-air, requiring a small motor-driven compressor. Current is carried into the excavator cab through collector rings, some 6 ft. in diameter, under the cab floor and surrounding the king-pin of the turning member.

The excavator in Fig. 30 is to dig an eight-mile section of canal, which will require about three years. Each excavator has a 112-hp., 440-volt motor on the drag line, 50-hp. for turning and 5-hp. for driving the air compressor. Besides these there are on the job about 100 hp. on drainage pumps and 10 hp. driving the machine shop, making a total of about 450 hp., and these contractors now have under consideration the subject of a complete electrical cooking equipment for their camp boarding house.

The central station furnishing power for this project extended its 33,000-volt transmission line about four and one-half miles to the middle of the canal section where a substation was installed stepping down to 2300 volts.

Two 2300-volt, 3-phase feeders are taken out of the substation and the pole lines are extended each way as the excavators move along. The 2300-volt feeders terminate on poles on especially built wagons for transformers stepping down from 2300 volts to 440 volts. From the transformer wagons about 150 ft. of 440-volt cables, lying on the ground, carry the current to excavator collector rings. Lighting current in excavator cabs is obtained by transformers located in excavator cabs, stepping down from 440 to 110 volts. There are three 100-kw. transformers in the 33,000-volt substation and three 50-kw. transformers are put on each excavator transformer wagon; other transformers stepping down from 2300 to 440 and 110 volts are scattered around the job as desired by the contractor.

The contractor guaranteed the central-station company enough income to warrant the 33,000-volt line extension (besides this there was incidental farm business along the way) ; the contractor erected a sheet-iron building for the 33,000-volt transformers and made his own line extensions at 2300 volts. The company furnishes all transformers and the current is measured at 2300 volts.

This installation has not been in operation long enough to furnish any accurate data on the cost per cu-yd., but during April, 1913, the power consumption was 48,480 kw-hr., the maximum demand on a 30-minute basis 156 kw. and the power bill

$929.09. The contractor is one of the most enthusiastic boosters of central-station current in the country.

ELECTRIC SHOVELS AND DRAG-LINE EXCAVATORS

H. HERTZ

Asst. Chief Engineer Bucyrus Co.

Numerous attempts have been made to design and build electrically operated shovels, but until within the last year and a half most of these attempts have been unsuccessful. A few direct-current shovels have been in operation and with careful handling it was possible to do some work with them; but they could not compare in output and efficiency with the steam machines, although the direct-current series motor characteristics should be particularly suited to excavating machinery.

To-day, however, it is not only possible to design and operate direct-current excavators successfully, but alternating-current electric shovels are being used quite extensively and the output and economy of these machines are not only equal to, but in many cases exceed that of standard steam shovels.

Due to the unsuccessful operation of electric shovels designed more than two years ago, there has arisen a prejudice against such machines in the minds of both central-station companies and users. The successful operation of recently designed shovels is, however, causing this prejudice to fast disappear and not only have contractors become very much interested in these latest improvements, which have a material bearing on their success in business, but power companies are beginning to realize that the electric shovel is a desirable load to carry, as in the operation of the up-to-date electric shovel the extremely high peaks have been eliminated, resulting in a satisfactory load curve.

With the exception of the few localities where coal is cheap and electric power rates quite high, it has been found that the cost of operation of electric shovels is considerably less than that of steam machines.

Some engineers still advocate the use of motor-generator sets and direct-current motors for driving the machinery on shovels supplied with power from an alternating-current circuit. But it is hardly conceivable that any man familiar with practical electric shovel operation, would consent to have a motor-generator installed on his shovel. The efficiency of an electric shovel equipped with direct-current motors and motor-generator set is very much lower than one which has alternating-current motors and transformers. Motor-generator sets, if installed on shovels, require a great deal of attention on account of the heavy vibrations of the shovel and are a continuous source of trouble. Furthermore, there are many places where it will not be necessary to use transformers in connection with alternating-current shovels, and this would make the shovel equipped with a motor-generator set considerably more expensive than a straight alternating-current shovel.

In designing an electric shovel it is of great importance to arrange the operating levers, motors and controlling apparatus in such a way that the controlling and operating characteristics during the various digging periods are similar to those of a steam shovel in order that shovel operators can shift from steam to electric machines without loss of dexterity. Experience has shown that by following the above program in designing electric shovels, the steam runner has had no difficulty in taking hold of an electric shovel; on the other hand it was found that men thoroughly familiar with electric motors and controlling apparatus, but without shovel experience, were not able to operate the electric machine satisfactorily.

The controlling apparatus must be designed and installed in such a manner that motors may be stalled at any time without undue overheating, or burning out; *i. e.*, the current should not greatly exceed the normal operating current and yet the motors must remain under control while stalled.

One and a half years ago the Bucyrus Company started to build its first electric excavators, and has since built and sold six different types of such machines. The following is a list of the first electric machines built by this company:

1—100-ton, 3-phase, 60-cycle, 440-volt shovel
1— 78 " " " 440 " "
1— 68 " " " 440 " "
1— 15 " " " 440 " "
1—Class 14, 3-phase, 60-cycle, 440 drag line excavator
3—Class 9½ " " 440 " " "

It is significant that all the above machines are operated on alternating-current circuits; and as the alternating-current shovel has presented greater difficulties in design than the direct-current machine, the following short description of one of these shovels may be of interest.

The main hoisting machinery of the shovel is connected directly to the driving motor through an air operated clutch identical with those used in steam shovels. This clutch is released only while the dipper is being lowered. The motor on hoisting machinery is of the slip-ring, mill type and is so controlled that the torque on the hoisting drum varies but little from standstill to full load speed of the motor. This requires a number of automatic solenoid switches in the secondary control of the motor, but it insures uniform and quick acceleration and as the control is provided with "jamming" (or cut back) relays, the arrangement affords full protection against excessive currents while the motor is stalled. When motor is stalled the current is only about 30 per cent greater than during normal operating conditions. The solenoid switches are identical with those used in steel-mill practise and have been found thoroughly satisfactory for shovel work.

The swing motor is similar to the main or hoist motor and is actuated through an automatic reversible control, the solenoid switches and relays being similar to those of the hoist. The control of the swing is so designed that the swing of the shovel may be reversed without causing the current taken by the motor to increase materially beyond the normal rated value. It has been found that the swing of the electric shovel can be made considerably faster than that of the corresponding steam shovel, and that the dipper can be "spotted" more accurately and quickly over the cars to be loaded.

The thrust motor which actuates the dipper handle is mounted on the shovel boom and is connected to the boom machinery through an air-operated clutch, which in case of severe shocks will slip and thus protect the motor mechanically. The motor itself is fully enclosed so that it will not be damaged by rain or oil from the hoisting chain. The thrust controller is mounted on the craneman's platform, and the lever motion is in a vertical plane, similar to that of the swing and hoist master controllers.

Each motor is protected by a circuit breaker and these as well as the solenoid switches and relays are mounted on panels located at the rear end of the shovel cab. A small motor-driven railway type air compressor completes the equipment. If the shovel is operated from a high-tension line, the transformers may be located behind the controlling panels and connected through an oil switch to the incoming line, which would enter through the back wall of the shovel house.

In some cases where the shovel or drag line excavator has to be moved considerable distances while in operation, it was found desirable to mount a self-winding cable reel on the machine. The cable itself should preferably be surrounded by a steel spiral, which affords a good protection against mechanical injury.

The illustrations show a couple of alternating-current electric shovels under actual digging conditions.

Fig. 34 is a picture taken at Lahontan, Nevada, where the United States Reclamation Service is building a dam in connection with their irrigation project. In the picture is seen an electric shovel and an electric drag line excavator. They are operated on a 2200-volt, 3-phase, 60-cycle line, but while the 2200/440 transformers are mounted in the shovel, the transformers for the drag line excavator are placed on skids a few hundred feet distant from the machine.

Fig. 35 shows the testing equipment and testers in connection with the shovel described.

Figs. 37 and 38 are of another and larger shovel operating in a stone quarry. This shovel is connected to a 2200-volt, 3-phase, 60-cycle line, the transformers being mounted in a house at the mouth of the quarry. In all cases steel spiral-covered cables were used for connection from the pole line or transformers station to the machines.

Exhaustive tests were made on all these machines and a few of the average results are given herewith. The curve in Fig. 36 shows the kilowatt input to a shovel working in a gravel pit.

It will be noted that the cycles of operation run quite uniformly. The maximum peak is 225 kw. The average input based on the complete train is 98 kw., while the maximum average for one cycle is 118 kw. The shovel was making about 2.8 cycles per minute during the entire test and the record speed of the shovel while loading a complete train of six 4-yard cars was 4 cycles per minute. This shovel has a 2½-yard dipper. The weight of the shovel is about 68 tons and the total motor capacity is 215 hp.

Observations covering several days of operation show that the kilowatt-hours per cubic yard of excavated material varies from three-tenths to six tenths, including power consumed for "moving up" the shovel. A similar test on a shovel operated under severe conditions in a quarry gave a kilowatt-hour consumption per cubic yard of from four-tenths to nine-tenths maximum. The curve in the figure shows that the peaks are of extremely short duration and consequently the maximum demand will be but little higher than the average kilowatt input.

The power-factor of the electric shovel loads may be expected to be from 60 to 70 per cent. Electric drag line excavators show similar characteristics to the electric shovels and the motors and control are similar to those used on the shovels. One of these drag line excavators manufactured by the Bucyrus Co., has been in operation for over a year and no repairs whatever have been necessary. The efficiency in power consumption is approximately the same as that of the shovels, and continuous test diagrams show that the peaks are very short and in the same ratio to the average kilowatt input as on the electric shovels.

With shovels and drag line excavators electrified, the Bucyrus Co. now has four of their standard line of apparatus developed for either steam or electric power. Approximately 60 Bucyrus dredges are operated by motors and in some cases the performance characteristics of these dredges were similar to those of the steam shovels described in this article.

CLAY WORKING INDUSTRIES

Among the out-of-door industries of rural districts the clay working industries rank high as power users. In almost every case brick and tile making plants have heavy power demands during daylight hours only, and, as is the case with stone quarries, these industries are usually closed down for the winter when the ground freezes, making their load an extremely desirable one for central stations.

The use of motor-drive for these plants has been spreading very rapidly of late and at present operators are very much interested in the subject. At all conventions of the industry more or less time is devoted to the subject of motor-drive and central-station service. The ideas of the average brick maker are crude on the subject, however, and considerable educational work is needed on the part of the salesman.

From the central station side of the question there are two general types of brick and tile plants; namely those giving their product a preliminary drying by means of steam before "burning," and those accomplishing the preliminary drying by means of waste gases from the burning kilns or by "sun-drying."

The first class of plants, those drying by steam, are a hard class for the central station to "sign up." As a rule considerably more boiler horse power is needed for the drying process than for manufacturing. With an engine driven plant the exhaust steam from the engine will be used during the daytime to keep the drier, a larger low-ceiled room, from cooling down too much and at night live steam is turned into the drier steam pipes and the product is dried so as to be ready to come out the next morning. With central-station power the boiler plant must be operated at partial load during the daytime to furnish steam to keep the drier warm as dried product is removed and new product put in, and at night the boiler plant must furnish enough steam to dry the product. With these conditions it is obvious that an isolated plant has a very good argument for its existence. There are conditions, however, under which this load can be obtained and every plant of this type should be studied carefully before it is classed among the almost hopeless prospects. The greatest field for work in this direction is probably the conversion of the plant to to a "waste heat drying" plant.

The second class of plants, those utilizing the waste heat from burning kilns for drying, is readily adaptable to central station service and comparative easy to get onto the lines. The "burning" of the product is the last part of the process of manufacture before shipment. In this class of plant the burning kilns are built over a system of tunnels. After the product is fully burned and kilns are cooling down, air is drawn down through the hot brick or tile, by means of fans, and conducted through the underground tunnels to such points as it is needed for drying purposes. In a plant of any considerable size there are usually several kilns cooling down at one time, so that sufficient hot air is available for drying purposes. The investment necessary for a drying system of this kind is heavier than with a steam heated drier, but practically all modern plants are being built on this plan because of the lower operating cost. The increasing cost of coal and the general availability of central-station service are two prime factors in the growing popularity of the waste heat system of drying.

With a system of this kind the fans handling waste heat gases for drying will operate 720 hours per month during the manufacturing season.

There are also two general types of plants depending upon the kind of clay made use of; that is plants using a soft, somewhat moist clay for their product and plants using a dry, hard clay, or shale. The latter kind of clay is almost rock in some places. The first machines in a plant depend upon the kind of clay used. Plants using a soft, moist clay put the raw material through "granulators" or "pug mills" for the first operation; the granulator being a mixing machine built like a trough in which revolves slowly a shaft carrying a number of heavy knives. Plants using a dry clay grind it up by means of "dry pans"; these being string pans in which heavy stones are revolved to pulverize the clay. In plants using a hard shale, the raw material is sometimes given a preliminary crushing in jaw crushers. After the preliminary crushing or mixing the process of brick manufacture is more or less the same for the different grades of material, the details varying only as the shapes and grades of the finished products of different plants vary.

In some localities enough clay is taken out of the pit during the "open season" to supply the manufacturing plant and store the amount needed during the winter months. Comparatively few plants do this, however, as the double handling, to and from storage, is expensive and large heated sheds must sometimes be maintained for this purpose.

Combined individual and group drive will be found best for the general brick plant. Brick making machines are slow movers and with single gear reduction machines it will generally be found necessary to interpose a jack-shaft between motor and machines. Operators must be able to stop and start individual machines quickly, hence general brick practise is to equip each machine, although perhaps driven by an individual motor, with a friction clutch. The main brick making machines will, as a rule, be placed very close together; so that, if desired, one large, high speed motor can drive a main shaft and the various machines belted from this main shaft, with comparatively small friction loss. One large main drive and individual motors on isolated drives will very often prove a most satisfactory arrangement. Motors of 440 volts are preferred for this industry on account of isolated motors at distant points.

Steam and electric shovels are used in the clay pit for loading small cars, and everything said of the use of these machines elsewhere in this report, applies to their use here.

The motor-driven machines of a building brick plant may consist of any or all of the following:

Shovel in pit for loading cars.
Haulage of cars to manufacturing plant; may be a hoist and cable, electric locomotive or Woodford tramcar system.
Crusher, usually of jaw type.
Dry pans.
Granulator or pug mill; names interchangeable; the first machine of this kind, in plants where there are two, being called the "granulator" and the second the "pug mill."
Bucket elevators.
Belt conveyors.
Corrugated rolls for removing rocks from clay.
Auger brick machine and cutting machine; these two being geared together and driven by the same power unit.
Off-bearing belt; this belt is usually driven by the same power unit that drives the brick machine.
Repress machines, in plants making high-grade brick.
Off-bearing belt, second section carrying brick to "belt boys," who take brick from the fast moving belt and pile them on cars to be run into the drier.
Transfer cars; brick cars are run onto transfer cars and moved to a point opposite where the burning kiln is to be built; cars are run off on temporary tracks and a
Setting machine takes brick from cars and places them in burning kiln. The setting machines and transfer cars, as built at present, require direct current.
Blower to furnish air for oil burners under burning kilns.
Fans to handle waste heat gases between burning kilns and drier.
Pumps to remove water from clay hole.
Pumps to supply oil to oil burners.
Miscellaneous auxiliary apparatus incident to each plant.

COAL MINES

The mining of coal forms one of the largest industries of the world. With an abundance of cheap fuel close at hand it has, until recent years, been a somewhat hard problem for central-station companies to prove to the coal operators that power can be purchased more cheaply than it can be made in an isolated plant immediately adjacent to the mine.

The coal operators have now been educated to the fact that the coal used in their plant should be charged at the price it would bring them if sold on the market, that depreciation costs run into high figures very fast and to the fact that they have not really known their actual costs in the past. They now realize that the complete electrification of a mine invariably means a greater output and more economical operation. Electrification, to effect the incident savings, means the purchase of new equipment and the adoption of central-station service means a lessened investment to make the change. Considering all these factors the mining industry is one of the most active industries existent for the sale of central-station service.

This subject is too broad for the Committee to more than touch upon, and no attempt is made to do more than call attention to the fact that the industry should be given special attention by the Association in the immediate future.

Mining load is of an extremely diversified nature, there being almost as many special problems to consider as there are mines to furnish with power. Some mines run 12 months per year, others only during summer months and others but a few months during the fall. Some mines run 8 hours per day and others 24. Monthly load factors from 6 per cent to 60 per cent are found for individual mines.

From the power engineer's standpoint some of the matters to be considered will be the hoisting of coal from the mine, transportation of the mined coal, drilling or other means of cutting coal, ventilation of the mine and pumping.

In some "shaft mines" the hoisting is one of the larger problems of the mine. The size of hoist motors varies from 50 to 2000 horse power. The smaller size hoists can be taken directly upon a transmission line, but the load fluctuations of the larger size hoists are so severe that no transmission system will stand the strain and it is necessary to interpose a fly-wheel motor-generator set between the line and the hoist motor. Such a motor-generator set consists of an alternating-current motor driving a fly-wheel weighing from 5 to 20 tons and a direct-current generator. The alternating-current motor has a "slip regulator" connected into its electrical circuits so that when the direct-current hoist motor is making heavy demands upon the direct-current generator, the alternating-current motor will be slowed down and the stored energy in the heavy fly-wheel made to furnish the power required. A properly designed and installed slip regulator controlled motor-generator will smooth out the extremely fluctuating load curve of the direct-current hoist motor so that the demand upon the transmission line will be practically uniform.

In "slope mines" or "drift mines" the hoisting conditions are not so severe. The hoist motors for these classes of mines are very much smaller than in shaft mines and the problem more easily solved. In some cases the entrances have but slight grades and the hoisting problem disappears and becomes part of the transportation scheme.

Electrical haulage of cars in mines is one of the most popular adaptations of electricity. Small electric locomotives are used to "gather" the cars from various outlying parts of the mine and larger locomotives to take the trains or "trips" made up by smaller locomotives to the mine entrance. Electric haulage is not permissible in some very gaseous mines, however, and then compressed air locomotives are resorted to; making the installation of air compressors necessary.

Motor-driven channelling and coal cutting machines are becoming very popular in mine service, replacing in a great many places the old compressed air machines. The adoption of motor-driven drilling machinery effects a great saving in mine work as it cuts out a great network of compressed-air mains and pipes with their unavoidable air leaks and steady loss of power.

Mine ventilation is one of the big and variable problems of mines. Mines in one part of the country will be comparatively free from gases and require small motors only to drive the ventilating fans, while in another part of the country 300 or 400 horse power will be needed on the fans. The fans run continuously and considerable attention is being given to this problem at present to increase the efficiency of both fans and systems of motor-drive, so as to reduce operating costs. The utmost reliability is required of equipment on this service.

Mine pumping assumes very special and formidable proportions at times. The distances from working face to main sumpt are often long and numerous points must be kept clear of water; the discharge head between sumpt and ground level is often high. No one type of pump can be adopted for all services; each case has to be decided according to conditions.

The allowable voltage in mines is usually regulated, the laws in different States varying on the subject. Some States allow the use of 500 volts on trolley systems and other exposed wiring, while others limit such wiring to 275 volts. Few limitations are placed upon alternating-current voltages where wires are thoroughly protected from mechanical injury and all switching is fully safe-guarded from contact by workmen.

SECTION III

RURAL DISTRIBUTION

As stated at the beginning of this report, central stations that have entered into campaigns for "farm business," especially in the eastern and central portions of the United States, have soon realized that the capital investment necessary, as a rule, to acquire such business is exceedingly heavy when considered from the standpoint of the income therefrom.

The farmer can pay for higher rates than are usually charged him by the central-station companies and still save money; and farmers all over the country are fast awakening to this fact and are anxious to get the service.

In some communities the farmers have financed local distribution systems of considerable size, taking current from a cross-country transmission line at one point and retailing it among themselves. In other localities individual farmers are required by the central-station company to pay for lines to their properties. Still other companies require a yearly minimum guaranteed income commensurate with the cost of the necessary extension. The methods of taking on such business are the various acknowledgments of the different central-station companies of the relatively high cost of serving it.

The proposition of getting farm customers to erect and maintain their own line extensions is one depending greatly upon local conditions and each case of this kind must be considered as special and handled accordingly. There is some question among a great many companies as to the advisability of allowing other parties to erect and maintain lines attached to their transmission or distribution systems, because of the fact that the construction and maintenance of such foreign lines are often not equal in quality to that of the lines of the company. It is often hard to control the work on such lines and they sometimes become a hazard to the service of the central station. Where it is desired that the customers of a certain locality shall finance and own their own distribution system, retailing current among themselves, it will often be found advantageous to the central station, from a service standpoint that a special contract be made with the community whereby the central station shall erect and maintain such lines, billing the community at cost on the work.

Probably the most general policy covering line extensions to such customers is the one requiring a guaranteed income for a five-year period, equivalent to the cost of the extension, not counting transformers as a part of such cost, in from one to three years, according to local conditions and the condition of the money market at the time the extension is made. In this way the central-station company retains ownership and absolute control of all lines carrying its current and can better control its system. This being the more general scheme of procedure among the large companies it is made the basis of the discussion which follows:

In the Central States the individual farm is small in comparison with holdings common in the West, the crops are not of as high value per acre nor are they very greatly dependent upon irrigation for their success; hence there are comparatively few irrigation installations of any importance, except here and there for a truck garden, and the connected loads of individual farms are small. These loads are too far apart for several farms to be fed from one transformer or transformer bank, and the transformer investment and losses at times become items of importance in certain localities. A majority of farms using electric power to any extent will require 15 kilowatts in transformer capacity, yet the 15-hp. motor requiring such capacity will operate comparatively few hours per month and a great deal of the time the transformer equipment will be working lightly loaded. This average light load on transformers only makes the investment cost high per kilowatt-hour consumption, but the charging current of the lightly loaded transformers has a tendency to increase the drop on such lines and injure the regulation.

Considerable attention has been given to the subject of rural distribution during the last two years and great advance has been made in the design of equipment to cheapen such work. Out-of-door substations have been developed by several companies and the larger manufacturing companies are working at present very actively on the design of various types of these stations, ranging all the way from simple transformer installations with necessary protective apparatus, to substations of some magnitude having automatic regulators for voltage control. Careful thought has been devoted to fuses for use with isolated transformer installations on medium and high-tension lines. These out-of-door substations have been designed to be as cheap as possible, consistent with rigidity, and their cost per kilowatt of transformer capacity has been brought down to a very low figure. They are assembled in the field with bolts, so that a larger capacity substation can replace a smaller station at any time and the latter be removed to a new location, without any damage having been done to the structural work in the disassembling.

The Transmission Engineering Co., of Pittsburgh, Pa., give the costs of out-of-doors substations such as are shown in Figs. 82 to 85, complete, but not including transformers, as follows:

Substation transformer capacity	11,000 to 15,000 volt	22,000 to 26,000 volt	30,000 to 33,000 volt
1—1 phase, 25 to 50 kv-a.	$210.00	$225.00	$276.00
1—1 phase, 100 kv-a.	235.00	280.00	303.00
3—1 phase, 50 kv-a.	290.00	356.00	394.00
3—1 phase, 100 kv-a.	300.00	364.00	402.00
1—3 phase, 25 kv-a.	250.00	315.00	303.00
1—3 phase, 100 to 150 kv-a.	275.00	342.00	386.00

We give herewith a discussion by Mr. H. W. Young, President of the Delta-Star Electric Co., Chicago, covering quite fully the subject of weatherproof substations.

Figs. 98 and 99 show detailed estimates giving the cost of erecting four types of distribution and transmission lines based upon the practise of one of the larger central-station companies and of present-day prices. Photographs of some of the classes of construction estimated upon in Figs. 100 and 101 are shown in cuts attached thereto.

The use of iron wire has been considered by perhaps every central-station company covering a sparsely settled territory, but such wire has not been very generally adopted. Rural distribution lines are generally rather long for the voltage carried and the regulation none too good, hence the fact that iron wire has a tendency to increase regulation troubles has been against its use. Iron wire has no salvage value when taken down. Claim departments of central stations have objected to its use on the ground that rust spots develop and the lines are liable to come down oftener than copper wire thus increasing the personal injury hazard of the company.

Copper-clad steel wire, with long span construction, has become quite popular of late and will probably be more and more used.

The subject of rural distribution is being considered in the Technical Sections of the Convention and the intention of this Committee is merely to point out to the Commercial Section the importance of the subject and, perhaps, increase somewhat the general knowledge along these lines.

THE WEATHERPROOF SUBSTATION AS A MEANS OF EXTENDING CENTRAL-STATION SERVICE

H. W. YOUNG

An advantage which many central stations enjoy is a surrounding farming district which needs electric power. The general awakening of the country as a whole to the necessity of improved farming methods has been reflected in the central station by considerable activity on the part of many managers to devise ways and means of making the farmer a permanent consumer of current. The farmer quickly recognizes the advantages of electricity in the operation of motors for running various machines, and when once electric power is adopted for a particular service he soon wants to use current for many other purposes. He is a large buyer of power and always a good customer.

Aside from the economy secured in operating motor-driven machinery and the convenience of electric light in the buildings, yards, etc., the use of electricity on the farm makes for greater safety from fire. As farm buildings are usually a long distance from effective fire-fighting apparatus, this increased safety gained by the use of electricity as opposed to gas engine and oil is a strong reason for the adoption of electric service.

In addition to the demand for power on a farm, there are in every farming community certain industries which convert farm products into finished products. These industries, while often small, offer a good incentive to the central-station manager seeking rural business. The advantage of securing these small industrial loads is that they give the central station an objective point to which lines can be built. The small farm consumers can then be served from the same line at a profit, whereas it would seldom prove a paying proposition to run lines to a single farm.

TYPES OF SUBSTATIONS

During the past two years rapid development has been made in the design and construction of weatherproof substations and the illustrations show some of the recent types.

Fig. 61 shows the construction of a 150-kw., 3-phase, 60-cycle station stepping from 33,000 to 2300 volts. The protective equipment consists of three single-phase units, each of which includes a disconnecting switch, a choke coil, a pair of horn gaps and carbon tetrachloride fuse. On the secondary or 2300-volt side is installed a weatherproof, non-automatic 3-pole oil switch. After the installation is completed, service is started by first closing the single-pole disconnecting switches of the protective units, following this by closing the non-automatic oil switch. To discontinue service the oil-switch is first opened and then the disconnecting switches.

To secure additional safety of operation a special type of insulated hook stick, as shown in Fig. 62, is employed to operate the disconnecting switches. This hook stick is provided with a brass ferrule to which a stranded copper cable can be attached and as the other end of the cable is connected to the permanent ground wire any leakage under the worst conditions will find a ready path to earth. In general, this type of substation is designed to confine all load switching to the low-tension side of the transformers, the disconnecting switches being called upon simply to break the exciting current.

A second station of recent design is shown in Fig. 63. With this equipment load switching can be effected on either the high or low-tension side. The high-tension switch is of the double-break type and so designed that all three phases are opened simultaneously at two points. The lightning arrester and fuse equipment consists of horn gaps, choke coils and carbon-tetrachloride fuses. The wooden poles are standard, although steel construction can be used if desired. The cross frames between the poles are steel, channel cut to length and ready for immediate assembly in the field. A small wooden or sheet-iron box is provided for housing a secondary control panel on which is mounted the necessary meters, oil switches, etc. This house is of such size that two automatic potential feeder regulators can be installed and, when desired, a street lighting regulator also. As a rule the street lighting transformer or regulator would be of the automatic weatherproof type and placed on a platform near the power transformers. Ease of inspection, accessibility of equipment, factor of safety secured and ready method of installing and removing transformers are especially characteristic of this type of substation. The compactness is rather remarkable, the poles being spaced 13½ ft. by 8½ ft. with two short stubs under the main platform. The cost of high-tension control gear is approximately $1.00 per kw. and little work aside from actual erection is necessary on the ground as all equipment is shipped ready for installation.

As an illustration of what outdoor equipment is called upon to withstand, Figs. 64 and 65 will be of interest. Fig. 64 shows two poles of a 3-pole switch heavily encased in ice, and Fig. 65 shows one contact during the opening position. It will be noted that the main contact has opened, the arcing contact still remaining in circuit and in position to take the burning incident to opening.

A third type of installation in which the high-tension control switches are mounted on a separate pole is shown in Fig. 66. With this equipment the transformers are simply protected with carbon-tetrachloride fuses and the high-tension line is controlled by three underhung disconnecting switches. This installation consists of three 50-kw. transformers connected to a 33,000-volt 60-cycle system. When it is desired to open the circuit under full load conditions, the three single-pole underhung disconnecting switches are replaced with the 3-pole switch shown in Fig. 67. A complete installation of this switch is shown in Fig. 68 and, as will be noted, the three switch blades are operated by a common handle or lever. Connection between the operating handle and switch elements is made by a vertical rod.

In some instances it is desirable to fuse the main or branch feeder lines and to meet these conditions the combination shown in Figs. 69 and 70 has been used to a considerable extent. It will be noted that three disconnecting switches are located on one pole and on the next are placed three underhung carbon-tetrachloride fuses. In one instance, which came under the writer's observation, this type of fuse successfully cleared a 10-ampere, 33,000-volt, 3-phase line without tripping the oil circuit-breakers at the generating station.

When single-phase service only is required, a type of installation shown in Fig. 71 can be used. The transformer is protected by combination horn gaps, choke coils and carbon-tetrachloride fuses. Switching is accomplished by means of a 2-pole switch operated by a lever handle. When fuse replacements or adjustments are to be made the lineman climbs the left-hand pole and after unlocking the operating handle raises and locks it in position. The entire service is now "killed" and access can be had to any part with safety. When leaving the station the switch handle is unlocked, pulled down to its closed position and again locked.

Another type of station protected with carbon-tetrachloride fuses only is shown in Fig. 72. This is a 150-kw. 33,000/2200-volt station in which all the switching is done from the next pole. This construction can first be used as single-phase and later converted to 3-phase.

COST OF WEATHERPROOF SWITCHING AND PROTECTIVE APPARATUS

The cost per kilowatt for the necessary switching and protective equipment is given below. These costs include the high-tension switches, high-tension fuses, choke coils, horn gaps and a non-automatic weatherproof oil-switch for use on the 2200-volt side.

Column A covers equipment suitable for load switching on the low side only; column B covering equipment for switching on either the low or high side, as desired. Where the secondary distribution is 110/200 or 440, the oil-switch can be omitted and a lower cost ordinary knife switch with steel box be substituted.

CONTROL AND PROTECTIVE EQUIPMENT COST PER KILOWATT

SINGLE-PHASE STATIONS

Kv·a	13,200 volts		22,000 volts		33,000 volts	
Cap	A	B	A	B	A	B
15	$8.00	$9.00	$9.00	$11.00	$12.00	$13.50
20	6.00	7.00	7.00	9.00	9.00	10.00
25	5.00	5.50	6.00	7.00	7.50	8.00
30	4.00	4.50	5.00	6.00	6.00	7.00
40	3.00	3.50	3.50	4.50	4.50	5.00
50	2.50	2.75	2.75	3.50	3.75	4.00

A, covers stations for load switching on the low side only.

B, covers stations for load switching on either high or low side.

CONTROL AND PROTECTIVE EQUIPMENT COST PER KILOWATT

THREE-PHASE STATIONS

Using Three Transformers in Closed Delta or Two Transformers in Open Delta

Kv-a	13,200 volts		22,000 volts		33,000 volts	
Cap	A	B	A	B	A	B
45	$4.00	$4.50	$4.75	$5.25	$6.00	$6.50
60	3.00	3.50	3.50	4.00	4.50	5.00
75	2.50	2.75	3.00	3.25	3.75	4.00
90	2.00	2.25	2.50	2.75	3.00	3.50
120	1.50	1.90	2.00	2.25	2.50	2.75
150	1.30	1.50	1.50	2.00	2.00	2.25
300	.70	.85	.85	1.00	1.00	1.15

A, covers stations for load switching on the low side only.
B, covers stations for load switching on either high or low side.

INSTALLATION COSTS

The price of poles, platforms, hardware, insulators, etc., and the cost of installation will vary with local conditions. A fair estimate is as follows:

Single-phase stations approximately.........................

Three-phase stations approximately ....

The above values are for 33,000-volt stations. The cost for lower voltages will be slightly less.

GENERAL INFORMATION

When planning outdoor substations the possible future growth should be given consideration. Make the platforms large enough to take transformers of larger size, as the additional initial cost is very small. Care should be taken to secure good construction, safety and convenience of operation. When the initial installation is single-phase the amount of protective and control apparatus is reduced by one-third. As the weight of the poles and platforms is less than for 3-phase stations a somewhat lighter construction can be used if desired. If, however, there is any possibility of future increase, either in single-phase transformers or by converting the station to 3-phase, it is better to plan for this increase and follow the 3-phase construction. The initial saving in a lighter construction is not an appreciable percentage of the total cost and it is better practise to allow for growth and expansion by the standard 3-phase construction.

SECONDARY DISTRIBUTION VOLTAGES

In the majority of cases it will be found advisable to adopt a secondary distribution of 2200 volts and distribute in the usual manner, using standard 2200-volt transformers to step down to 110/220 or 440 volts. When the load is close to the station it is feasible to distribute directly from the power transformers, using standard 110/220 or 440-volt circuits.

The 3-phase equipment can also be used to distribute 4-wire, the 3-phase grounded neutral giving with a standard transformer a secondary distribution of 2300/4000 volts. This is especially advisable when the consumers are scattered and minimum distribution losses are desired.

SERIES STREET LIGHTING EQUIPMENT

When outdoor substations are to furnish current for commercial service in towns, it is good practise to mount the weatherproof street lighting transformers or regulators on the same platforms as the power transformers. Sufficient room on the platform is available for this purpose and the street lighting circuits can be controlled either manually or by time clocks. The use of automatic self-starting and self-regulating street lighting equipment is now possible and will effect a material saving both initially and in operation.

CONTINUITY OF SERVICE

While absolute continuity of service is desirable, yet in the present state of the industry this can hardly be expected from commercial weatherproof substations. To secure this feature frequent and regular inspection would be needed and in addition protective equipment requiring daily supervision or attention would have to be installed. The initial cost of such equipment is at present prohibitive and the maintenance expense is too great to permit of a fair return on the investment. As with a proper switching and fuse equipment the main causes of interruption are static disturbances or surges, provision should be made to discharge excess potentials to earth without permitting the disturbances spreading to the entire network or back to the generating station.

The commercial forms of horn gap arresters now available are set to "spill over" at a predetermined point and can be so located that in case of heavy or continued flow of current to ground a fuse will blow. Under the imposed conditions as presented it is better to clear the lines automatically and localize the trouble rather than permit it to spread. This means a few possible interruptions during the year, but it is better to stand these interruptions and make a fair return on the investment than to try to secure absolute immunity at a cost which would render the venture unprofitable.

SAFETY OF OPERATION

Each substation should be provided with a permanent ground connection to which can be grounded the transformer cases, bases of switches, protection units, etc. When operating single-pole disconnecting switches the hook stick handle should be grounded as previously outlined. When the maximum factor of safety is desired the high-tension disconnecting or control switches can be located on the next pole as shown in Fig. 66. This arrangement is less convenient than that shown in Fig. 63, employing a 3-phase switch on the same structure. As with the latter arrangement the switch in the open position has a spacing between the "hot side" and the fuse equipment of approximately five feet and it is obvious that the construction is safe in the ordinary sense of the word. If, however, it is felt that a lineman might deliberately crawl out over the frame to the "hot side," it might be advisable to mount the switches on a separate pole.

ORDER OF SWITCHING LINES

Engineers differ in their opinion as to the order on which switches should be closed or opened under load conditions. Equipment is now available so that load switching can be accomplished on the high side only, on the low side only, or on either side, as desired. The choice of equipment must be decided by local conditions.

HANDLING TRANSFORMERS

By the use of an ordinary gin pole the transformers can easily be raised or lowered from the platform. The platform planks can be taken up to facilitate removal.

EXTRA EQUIPMENT

It is desirable to mount a small box on the station platform in which to place extra fuses, a few tools, extra insulators, record cards, etc. These few parts are inexpensive and will be of value at times of interruptions.

DETAIL EQUIPMENT

Some of the various control and protective units employed in distributing high-tension power are shown in the illustrations. Fig. 73 is a single-pole disconnecting switch, which can be combined in two, three, or four-pole units. This type of switch is designed to open loaded circuits. Fig. 74 shows a simple disconnecting switch for mounting on the under-side of cross-arms. A combined disconnecting switch and carbon-tetrachloride fuse is shown in Fig. 75. For mounting on poles or walls of buildings the fuse is shown in Fig. 76 has a wide application.

A unit construction disconnecting switch, choke coil, horn gap and carbon-tetrachloride fuse is shown in Fig. 77. This in conjunction with the secondary weatherproof oil-switch furnishes a complete equipment for low-capacity outdoor substations. The combined switch and protective unit used with the outdoor substation illustrated in Fig. 71 is shown in Fig. 78. The channel iron base is secured to the cross-arms as shown in Fig. 71, and aside from serving as a mounting for the equipment also strengthens the entire structure. Between the adjustable discharge gaps and the transformers is located a heavy inductance consisting of an especially designed high-powered choke coil. The function of this inductance is to flatten out any abrupt static surge or disturbance which would otherwise cause strains on the transformer. As located between the transformer and discharge gaps, the choke coil reflects surges back to the gaps where they are discharged to ground. When the gaps discharge, the carbon-tetrachloride fuse is in series to ground so that in case of abnormal flow of current the fuse operates and prevents local disturbances from passing to the main line or generating station.

For the protection of high-voltage feeder lines, the weatherproof carbon-tetrachloride fuses and mountings illustrated in Figs. 79 and 80 have been extensively used during the past two years. A typical outdoor type of high-tension transformer is shown in Fig. 81 and, as will be noted, both the primary and secondary leads issue through petticoat bushings, insuring a permanently high insulation value.

The switching and control units illustrated are in commercial service successfully meeting the imposed conditions. Many other types will no doubt be developed in the near future so that central-station managers desiring to project rural lines will not be handicapped by lack of equipment. While the writer has been intimately connected with the designing of much of the equipment described, yet it could not have been so quickly developed without the testing facilities offered by operating companies who have created the opportunities so necessary for such development.

CONCLUSION

The Committee realizes that its decision is in direct opposition to what has been advocated in past reports on the subject. The decision is made, however, from what has seemed to be the experience of companies that have gone into the subject carefully, and must be stated frankly. The "farm business," as developed at present, does not furnish the central-station companies with returns commensurate with the necessary capital investment.

The unusual subject-matter of the report has been presented, however, to show that there are industries in rural districts which it will pay to connect up; industries which have not been covered by other reports to the Convention. In the rush to accumulate information on urban subjects these industries have been overlooked, yet many of them, merely outlined here, are important enough to make the subject of special reports to central-station commercial departments.

The American Institute of Electric Engineers has a special section of their organization upon the subject of coal mining, this section holding meetings of its own and striving to awaken greater interest in the matter of electrical drive for coal mines. The power salesman of central-station companies operating in coal regions should be active at these meetings and in the opinion of the Committee special attention should be devoted the subject by the Association.

The farm business is a fairly easy load for the salesman to pick up as soon as he has his transmission lines available. The automobile has educated the farmer to the comforts of city life and enabled him to get about the country more than of yore. In his travels to his more distant neighbors he sees electric motors taking the drudgery out of farm work and he will adopt the service just as soon as a reasonable proposition is made to him. Salesmen for this class of work need to forget that they have come from the city to tell an uninformed man what he wants. The "hay-seed" farmer has disappeared and in his place is a rather well-read man who has been instructed by Government circulars, mail-order house catalogues and weekly papers. He generally knows what he wants and the salesman has his usual task of explaining certain details of apparatus and operation and the nature of the contract he has to offer; to convince his prospect of the low cost and fairness of the proposition.

The men in control of the industries touched upon are all city men and most of the sales work will be done in the front office. The salesmen must know the details of each industry they are working upon, be able to talk in the language of the industry and to meet the officers of the company on any angle of the subject.

In closing the Committee wishes to thank the General Electric Co. and the Westinghouse Electric & Manufacturing Co. for cuts and data supplied, and to express its appreciation to those outside engineers and magazine editors who have contributed to the report.

Respectfully submitted,

Committee for the Central States

C. W. PENDELL, *Chairman*
E. P. EDWARDS
H. W. COPE
J. F. MCGUIRE
L. B. JUDSON
A. H. HUTCHINGS

MACHINES SHOWN BY THE EDISON ELECTRIC ILLUMINATING CO. OF BOSTON, IN THEIR "FARM OF ELECTRIC LIGHT AND POWER"

MACHINES

Kind of Machine	Hp. of Electric motor required	Size	Cost	Maker	Location
Ensilage cutter	15	Ohio No. 11	$90.00	Silver Mfg. Co.	Salem, Ohio.
Feed grinder	2 to 8	Stover No. 4	27.00	Stover Mfg. Co.	Freeport, Ill.
Oat crusher	2 to 4	Gibson No. 16	300.00*	Gibson Oat Crusher Co.	Chicago, Ill.
Corn sheller	1 to 2	Favorite	35.00	Marseilles Co.	East Moline, Ill.
Clover cutter	1/2	8 in. feed	10.00	Ames Implement & Feed Co.	Boston, Mass.
Horse groomer	1	Priest No. 9	137.50*	American Shearer Co.	Nashua, N. H.
Hay hoist			18.50	Ames Implement & Feed Co.	Boston, Mass.
Nelson friction windlass	2 to 6	No. 1	50.00	J. B. Porter & Co.	Ottawa, Ill.
Wood splitter	2		133.00	Hildreth Bros.	Harvard, Mass.
Cord wood saw	3 to 7 1/2		25.00	Bauer Bros.	Springfield, Ohio.
Root cutter	2		13.00	Ames Implement & Feed Co.	Boston, Mass.
Cider mill	2 to 5		65.00	Ames Implement & Feed Co.	Boston, Mass.
Pump jack			15.00	Gould Mfg. Co.	Boston, Mass.
Pump	1	3 in. cylinder	173.00*	Gould Mfg. Co.	Boston, Mass.
Table saw	2 to 5	Crescent No. 1	71.00	Tho. Growther Co.	Boston, Mass.
Bottle washer	1/8				
Cream separator	1/8	650 gal. per hour.	150.00*	P. R. Zeigler & Co.	Boston, Mass.
Churn	1/2	100 gal.	155.00*	Creamery Pkg. Co.	Chicago, Ill.
Milk tester	1/8	6 tubes	49.00	H. E. Wright & Sons	Charlestown, Mass.
Bottle washer	1/8		25.00	H. E. Wright & Sons	Charlestown, Mass.
Milking machine	3	Pump, B.L.K. No. 4	380.00*	D. H. Burrell Co.	Little Falls, N. Y.
Brooder		60 chicks	14.00	Cyphers Incubator Co.	Buffalo, N. Y.
Incubator		60 eggs	16.00	Cyphers Incubator Co.	Buffalo, N. Y.
Sewing machine motor			25.00	The F. Bissell & Co.	Toledo, Ohio.
Vacuum cleaner	1/3		90.00	The F. Bissell & Co.	Toledo, Ohio.
Kitchen cabinet		5 machines	175.00	Federal Sign Co.	New York City
Ice cream freezer	1/8	1 gal.	46.50*	F. E Whitney & Co.	Boston, Mass.
Portable breast drill	1/3		50.00*	Western Electric Co.	Hawthorn, Ill.
Furnace blower	1/10		27.50*	Electric Blower Co.	Boston, Mass.
Forge blower	1/15	1 fire	28.00*	Electric Blower Co.	Boston, Mass.
Fireless cooker		3 compartments	28.00	Detroit Fireless Stove Co.	Detroit, Mich.
Vegetable peeler	1/4	1 pk. capacity	150.00*	Morandi Proctor Co.	Boston, Mass.
Centrifugal pump		1½ in.	190.00*	Rider-Ericsson Eng. Co.	Boston, Mass.

*Indicates price including motor.

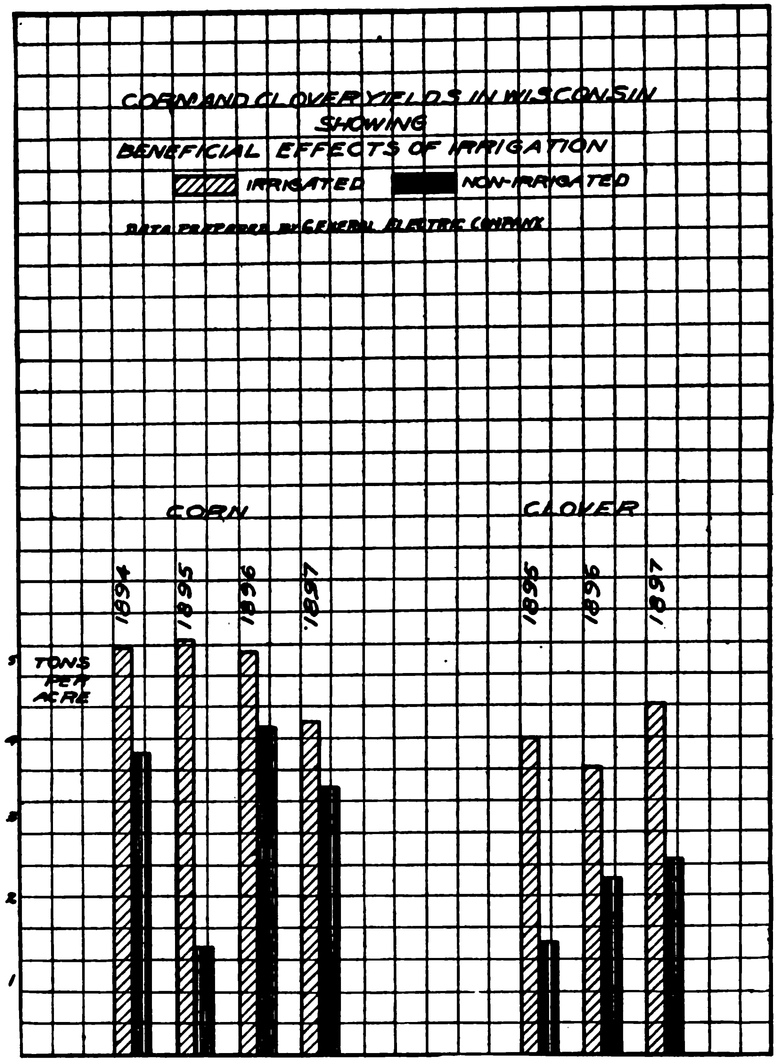


FIG. 1. CORN AND CLOVER YIELDS IN WISCONSIN

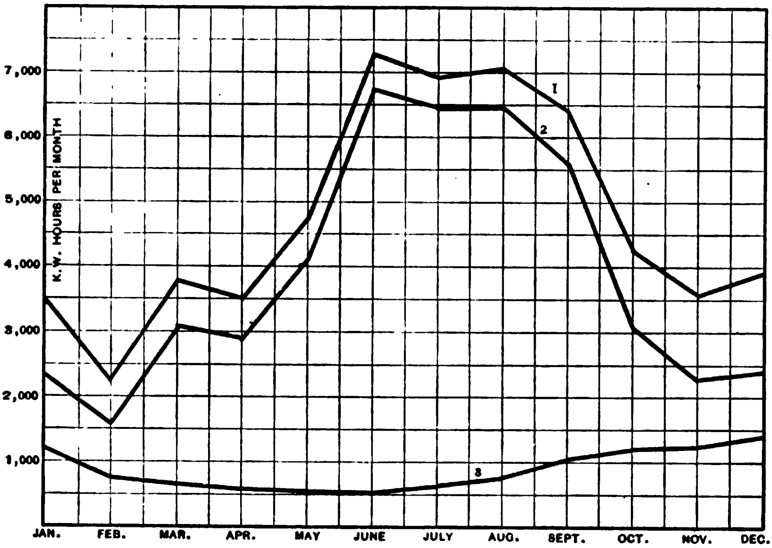


FIG. 2. CURVES SHOWING CONSUMPTION OF TWENTY-FIVE FARMERS ON PUBLIC SERVICE COMPANY'S LINES

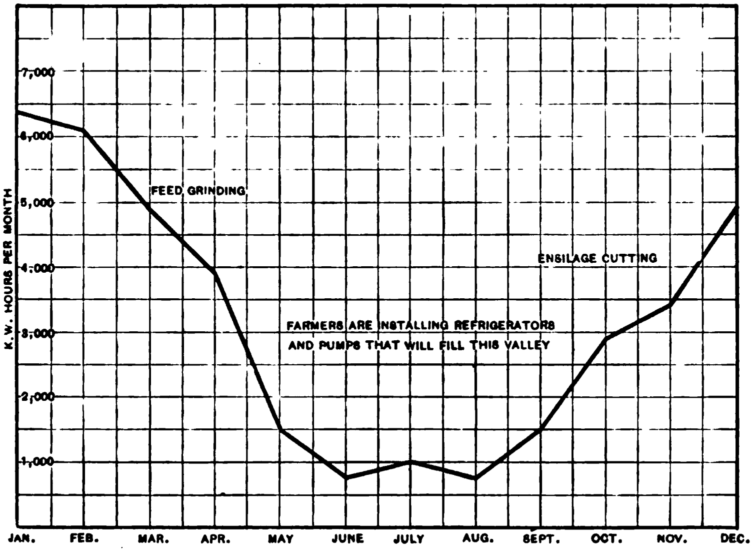


FIG. 3. CURVE SHOWING CONSUMPTION OF TWENTY-NINE FARMERS ON ELGIN ELECTRIC LIGHT COMPANY'S LINES

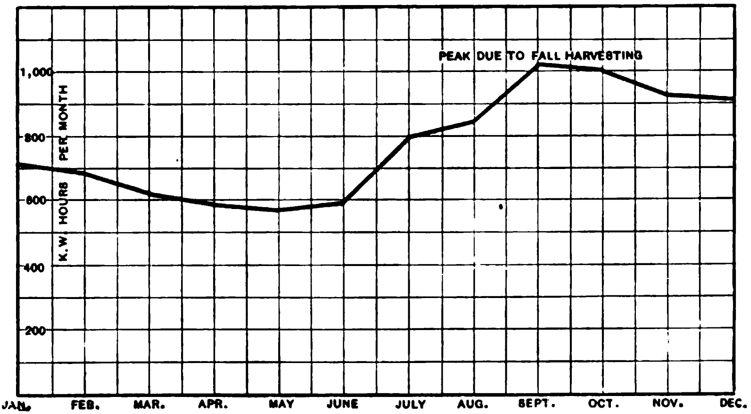


FIG. 4. CURVE OF CONSUMPTION OF 41 FARMERS ON ELMWOOD ELECTRIC LIGHT COMPANY'S LINES

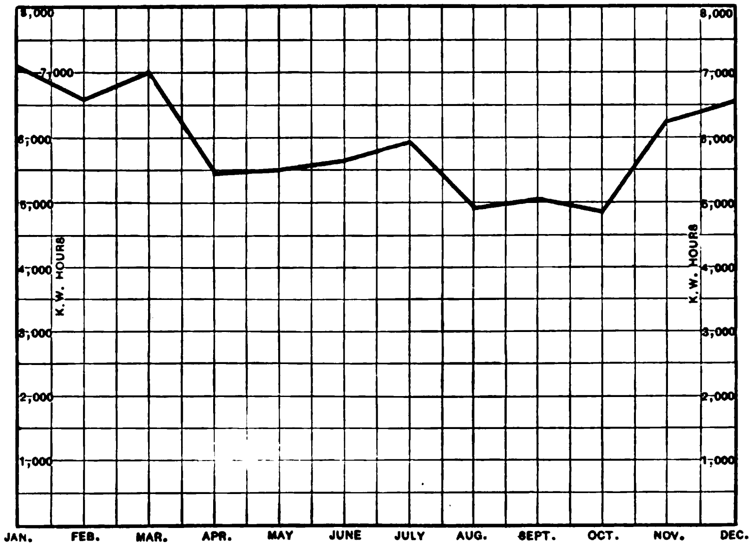


FIG. 5. CURVE SHOWING CONSUMPTION OF 157 FARMERS, ROCHESTER, N. Y.

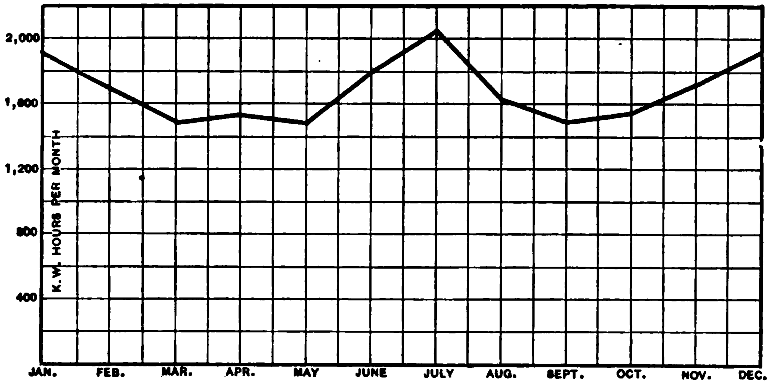


FIG. 6. CURVE SHOWING 43 MARKET GARDENERS' CONSUMPTION, ROCHESTER, N. Y.

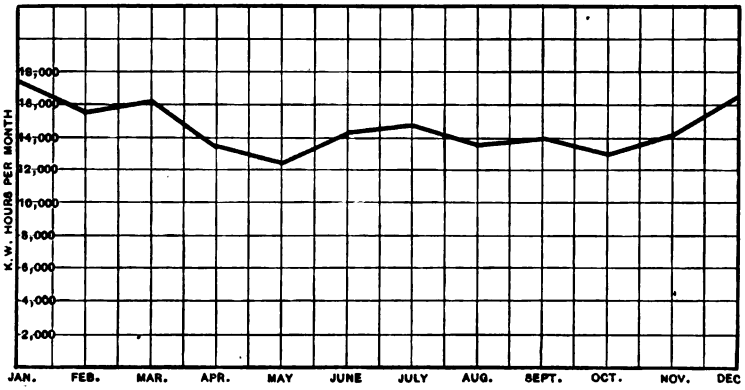


FIG. 7. COMPOSITE CURVE SHOWING CONSUMPTION OF 252 FARMERS

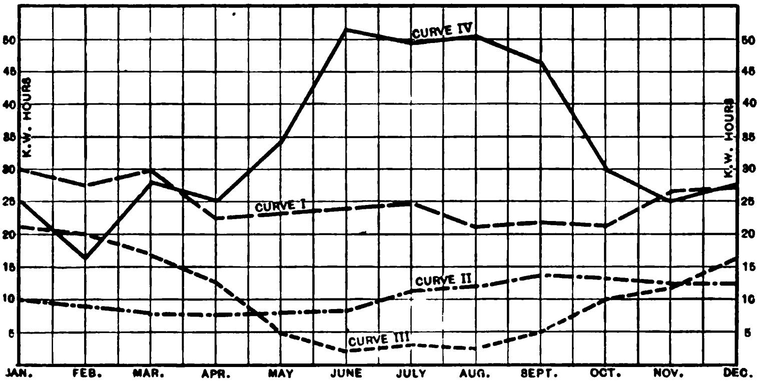


FIG. 8. COMPARATIVE CURVES OF CONSUMPTION OF FARMER CUSTOMERS SERVED BY DIFFERENT COMPANIES

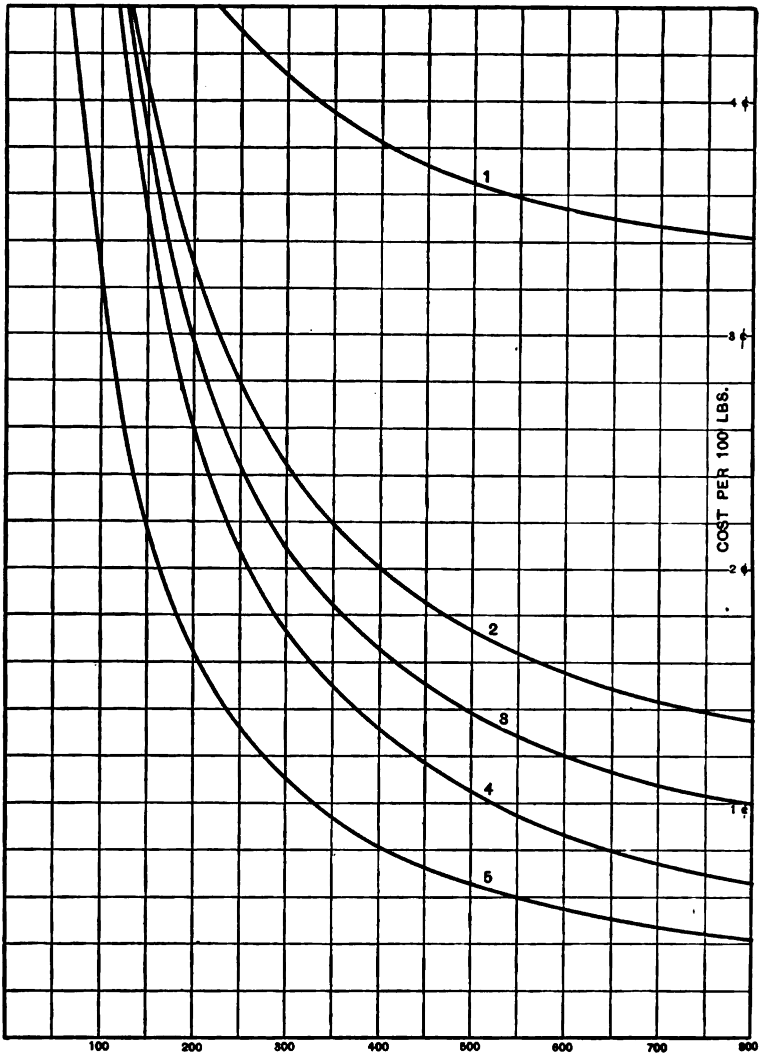


Fig. 9. Curves Showing Cost of Operating Cream Separators

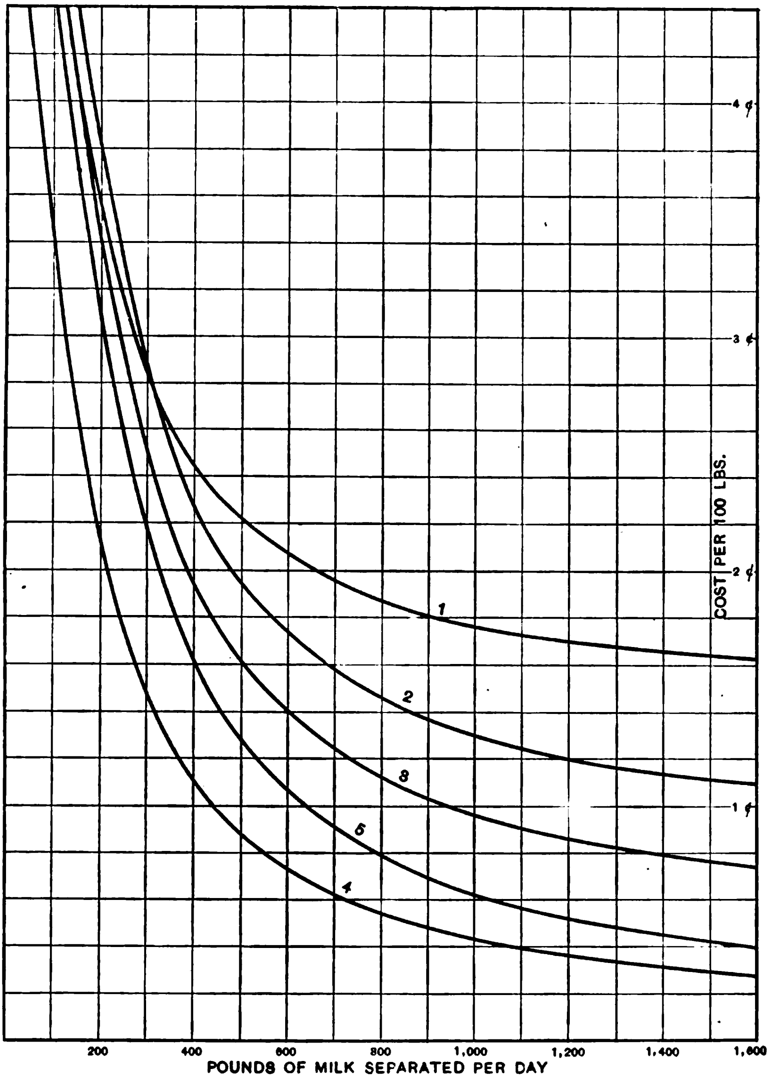


FIG. 10. CURVES SHOWING COST OF OPERATING CREAM SEPARATOR

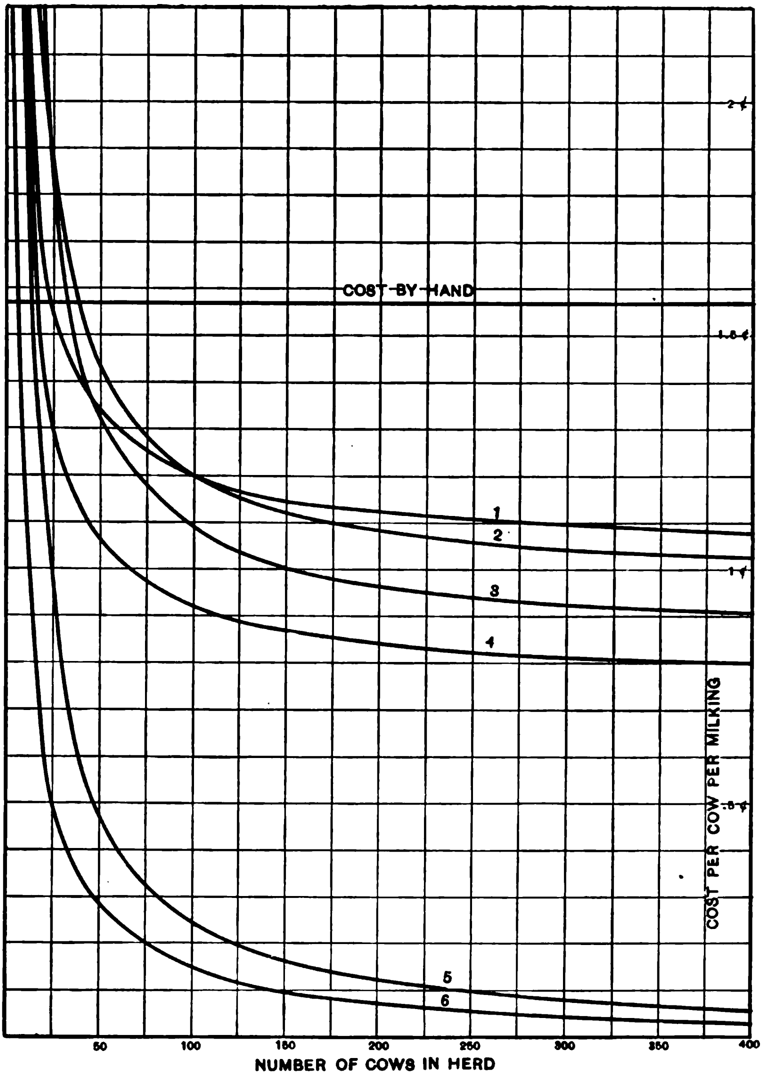


FIG. 11. CURVES SHOWING COST OF OPERATING ELECTRIC MILKING MACHINES

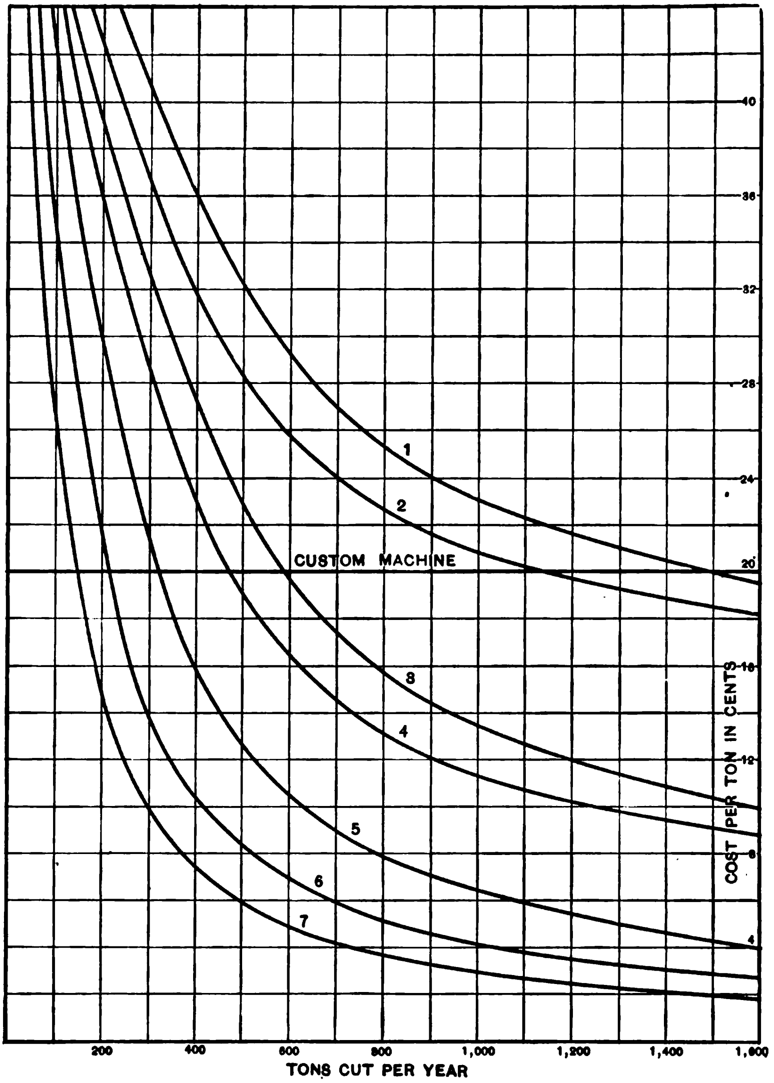


FIG. 12. CURVES SHOWING COST OF CUTTING ENSILAGE

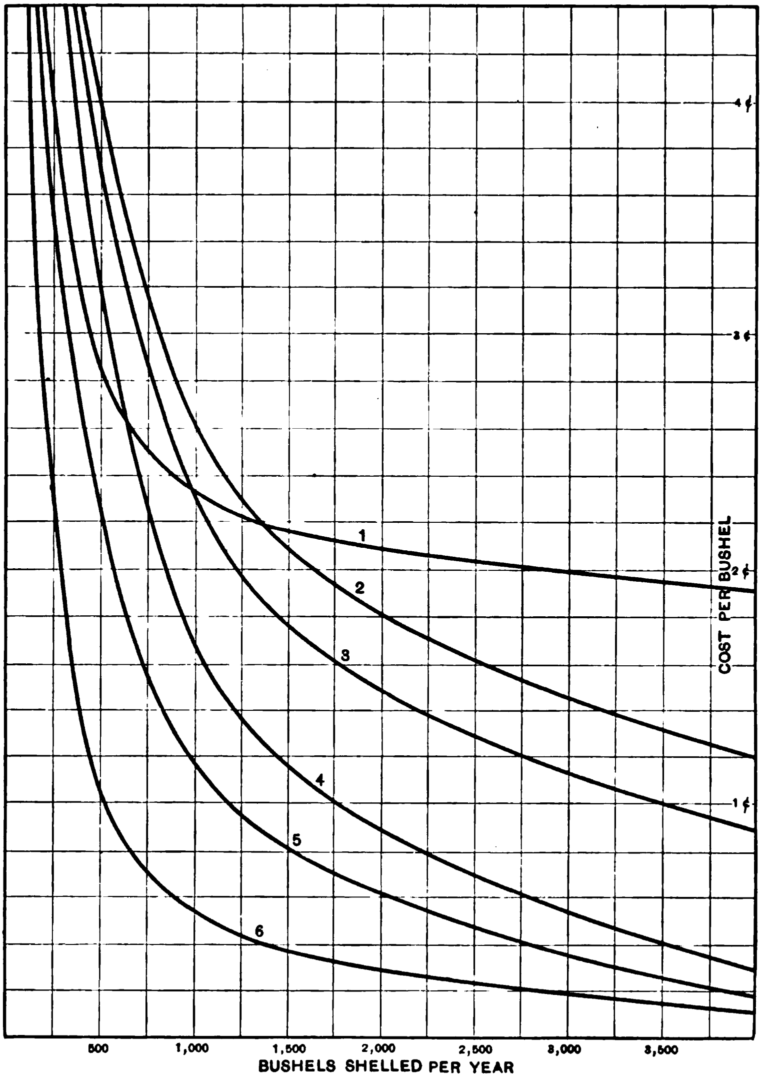


FIG. 13. CURVES SHOWING COST OF SHELLING CORN

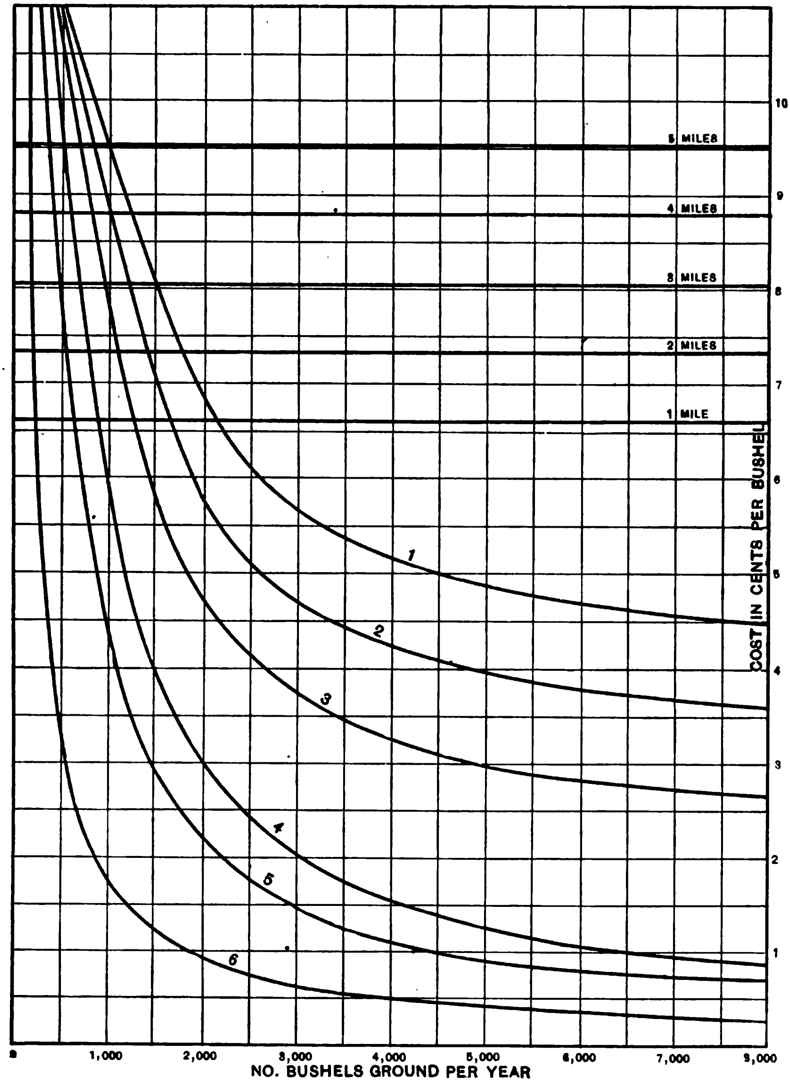


FIG. 14. CURVES SHOWING COST OF GRINDING CORN

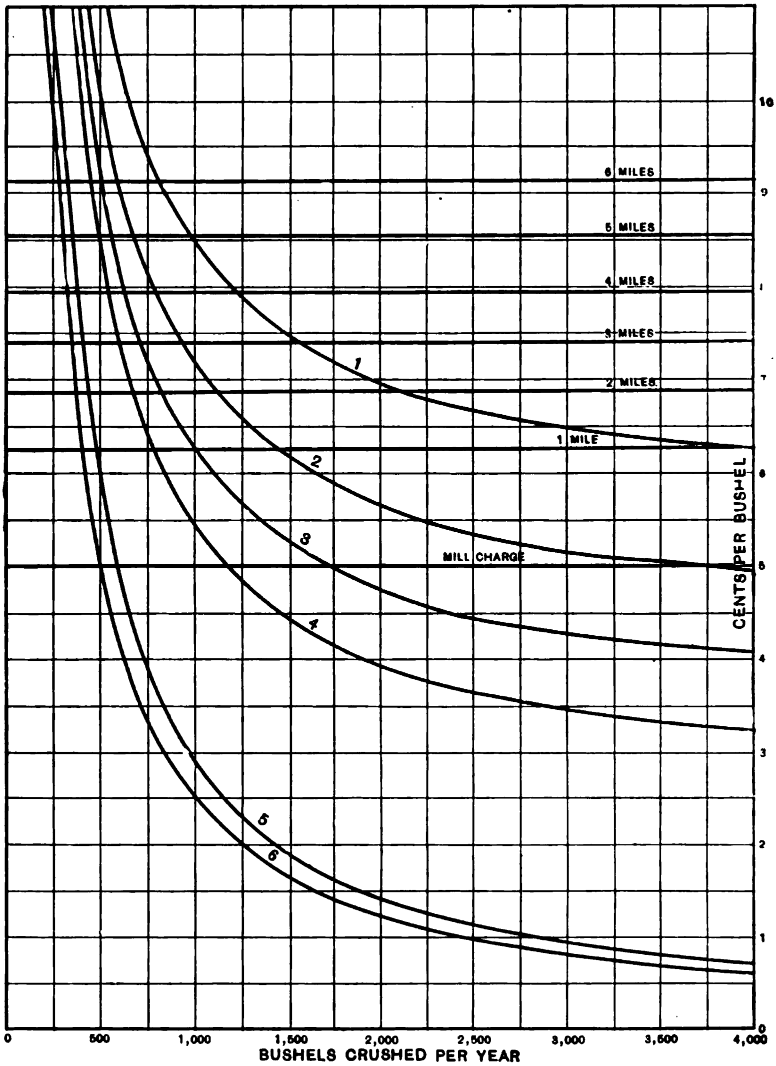


FIG. 15. CURVES SHOWING COST OF GRINDING EAR CORN

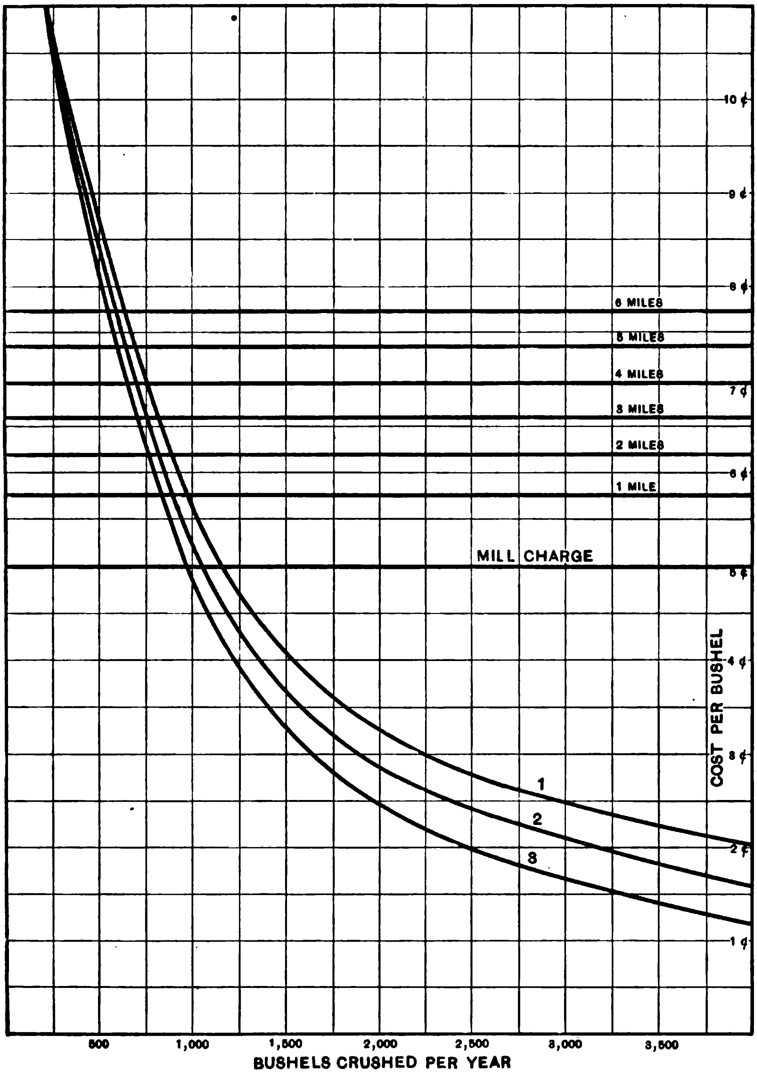


FIG. 16. CURVES SHOWING COST OF CRUSHING OATS

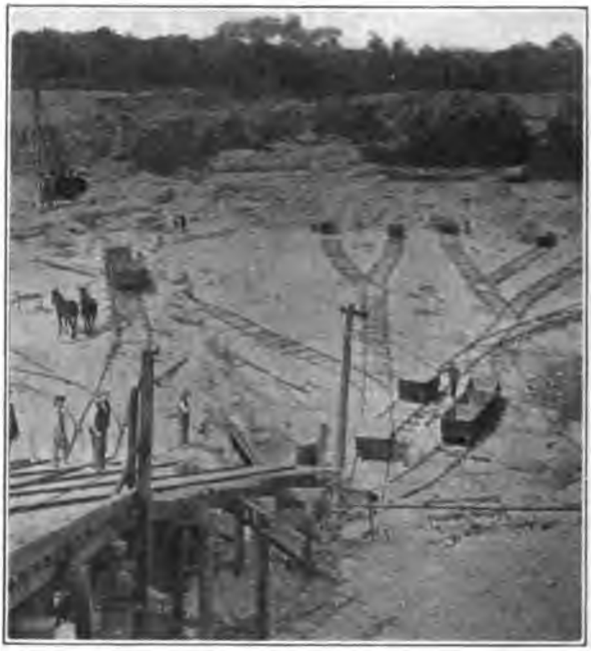


FIG. 17. PRINT OF RIVERSIDE LIME & STONE CO. QUARRY

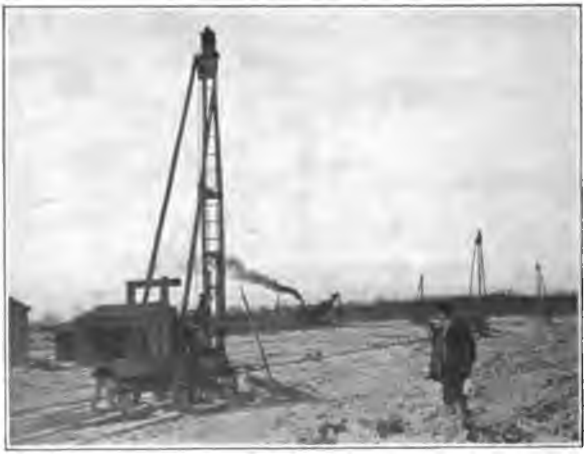


FIG. 18. WELL DRILLS AT BROWNELL IMPROVEMENT CO. QUARRY

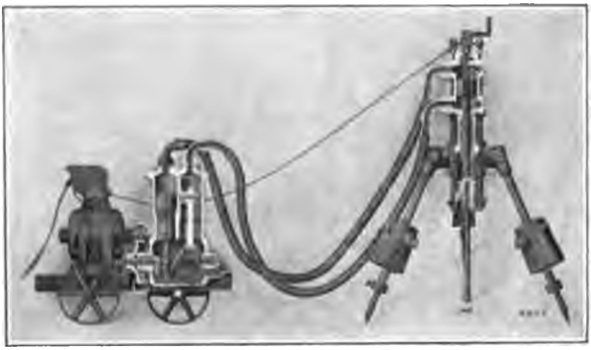


FIG. 19. PULSATOR ROCK DRILL

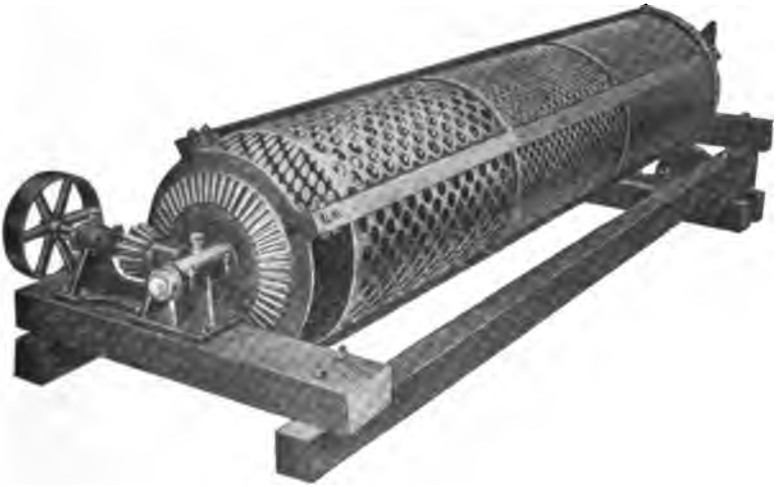


FIG. 20. ROCK SCREENS

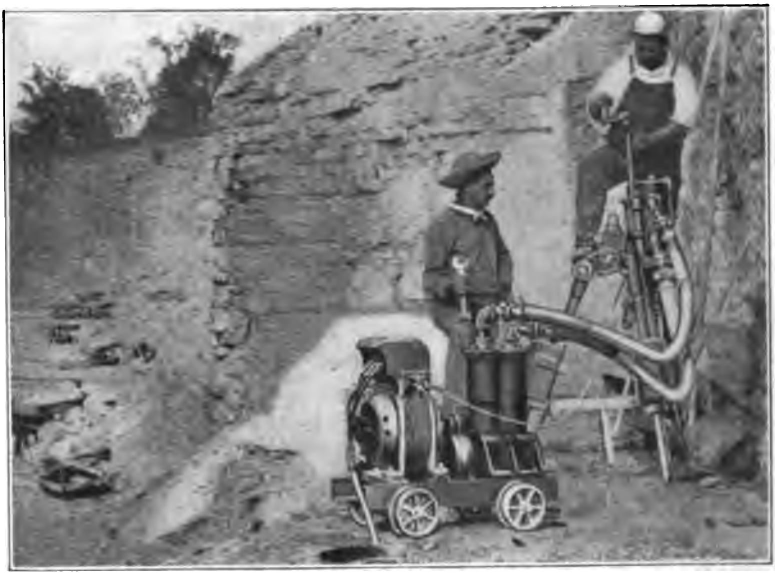


FIG. 21. PULSATOR DRILL AT WORK

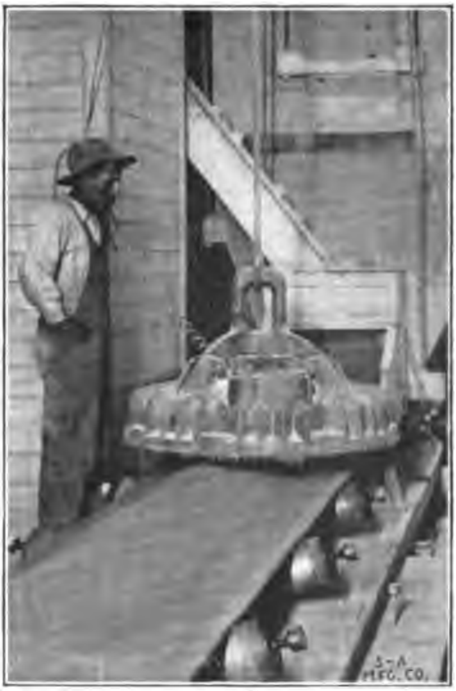


FIG. 22. ELECTRO-MAGNET OVER CONVEYOR BELT

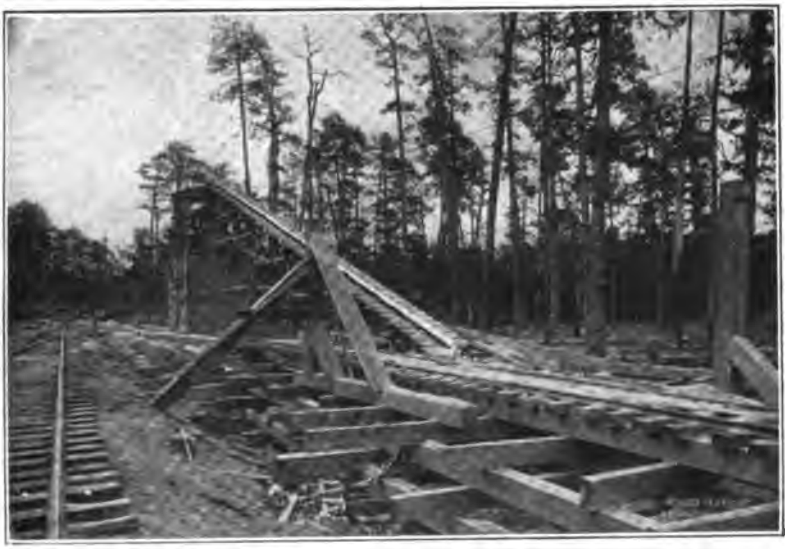


FIG. 23. SMALL SCREENING PLANT

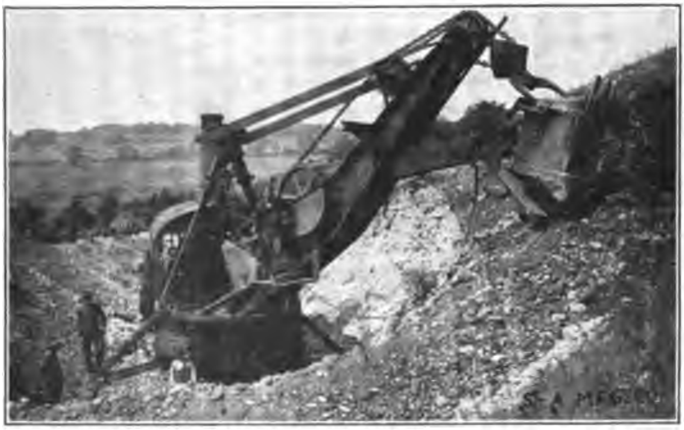


FIG. 24. STEAM SHOVEL.

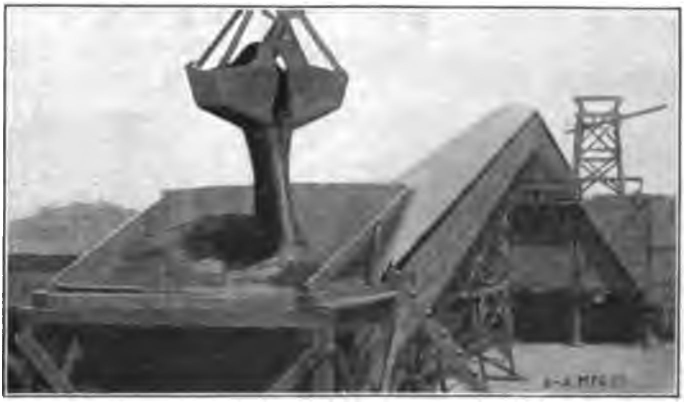


FIG. 25. CLAM SHELL BUCKET HANDLING SAND

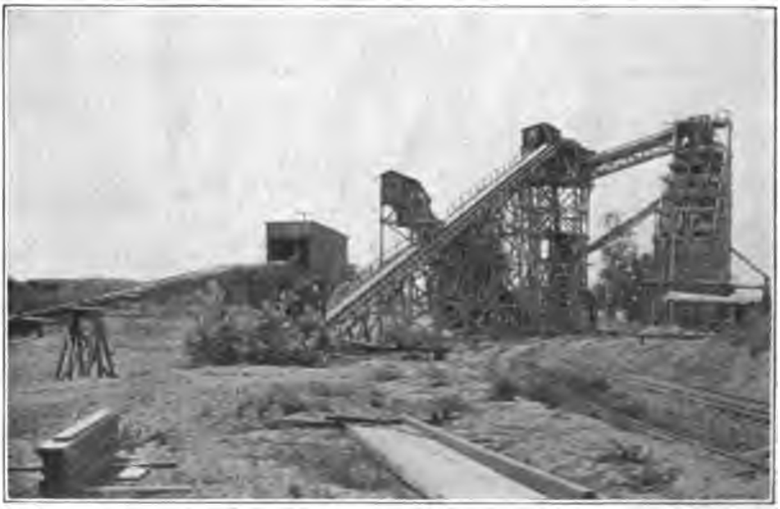


FIG. 26. SCREENING PLANT, NILES, CAL.

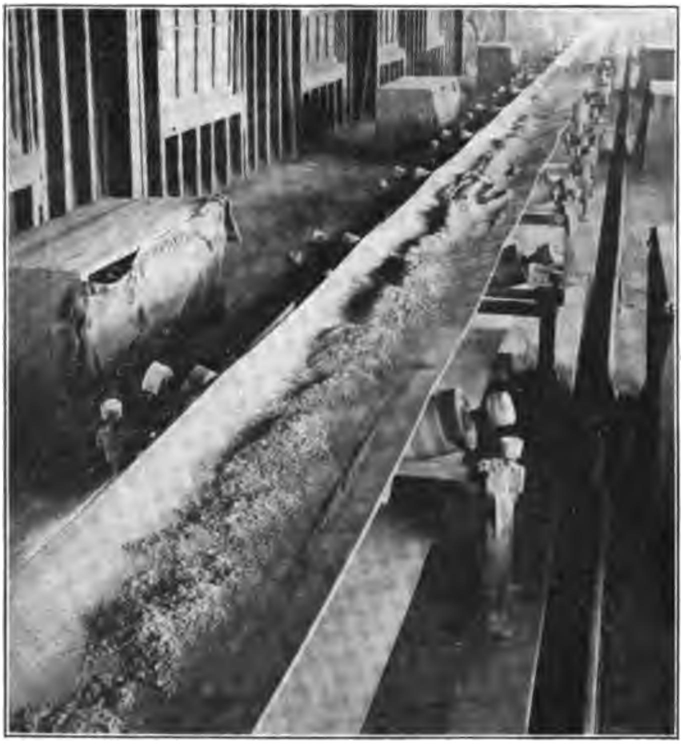


Fig. 27. Belt Conveyors

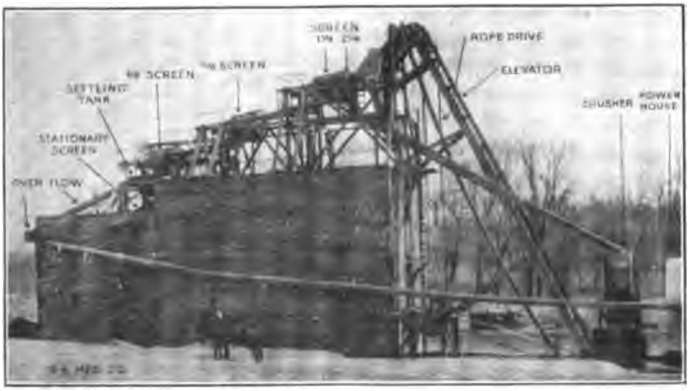


Fig. 28. Screening Plant

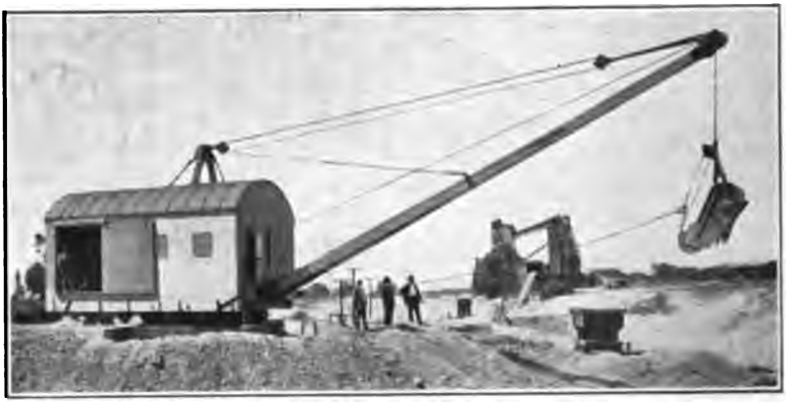


FIG. 29. CLASS "J," "LIDGERWOOD & CRAWFORD," DRAG LINE EXCAVATOR OPERATING ON A GRAVEL DEPOSIT OF NILES SAND, GRAVEL & ROCK CO., NILES, CAL.

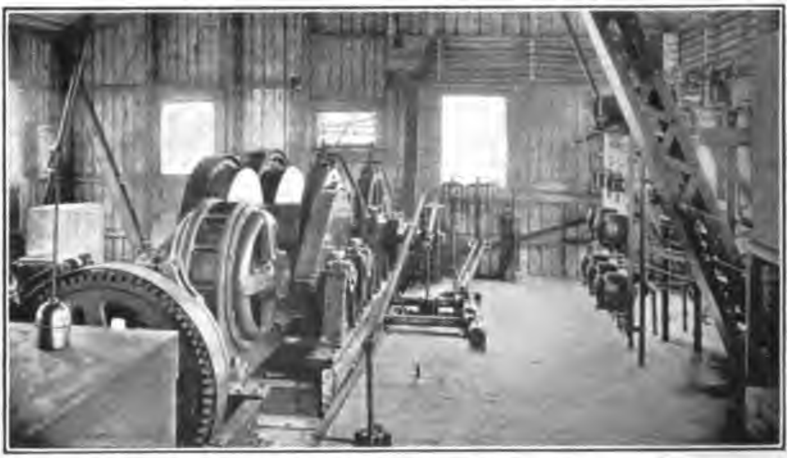


FIG. 31. INTERIOR ENGINE HOUSE, CLASS "K" "LIDGERWOOD-CRAWFORD" ELECTRICALLY DRIVEN DRAG LINE EXCAVATOR, SHOWING ELECTRICAL ENGINES AND COMPRESSED AIR AND ELECTRICAL CONTROLLERS

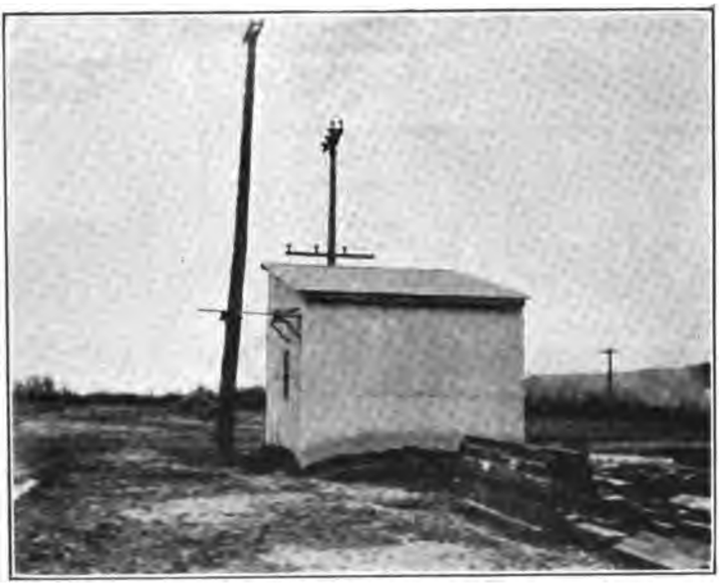


FIG. 32. SHEET IRON TRANSFORMER STATION ERECTED FOR CONTRACTOR ON EXCAVATING WORK

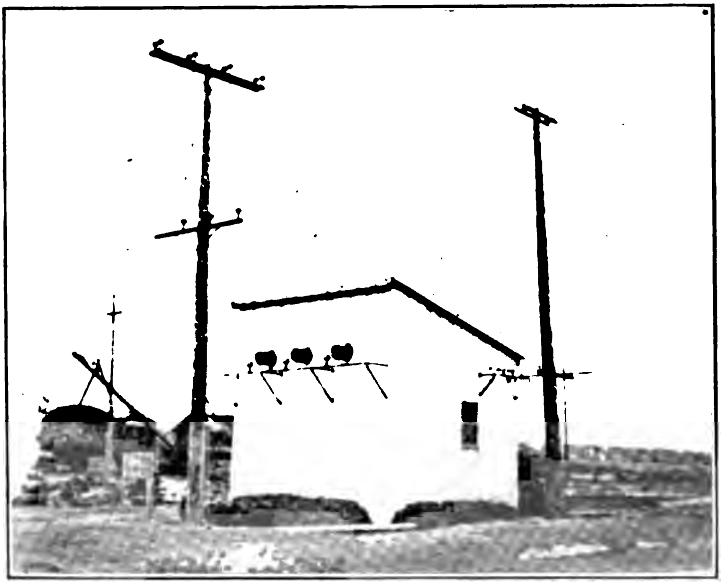


FIG. 33. ANOTHER VIEW OF TRANSFORMER STATION HIGH-TENSION LINE ENTRANCES

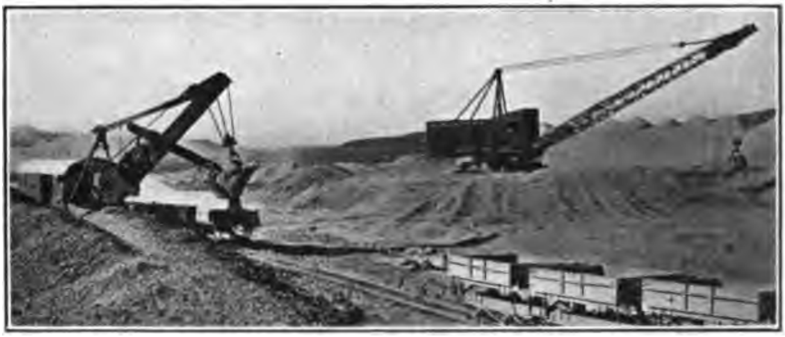


Fig. 34. Neat View of the 60-Cycle Bucyrus Electric Shovel and Class 14 Bucyrus Electric Drag Line Excavator

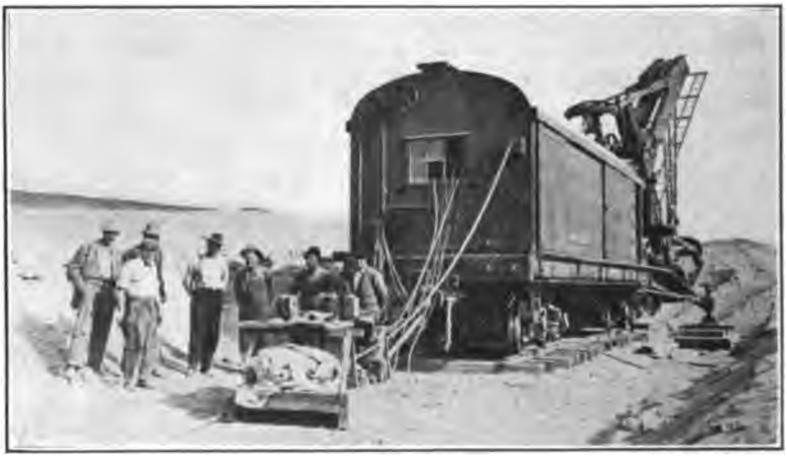


Fig. 35. Showing Meters Set Up for Test of 60-Cycle Electric Shovel Shown in Fig. 34

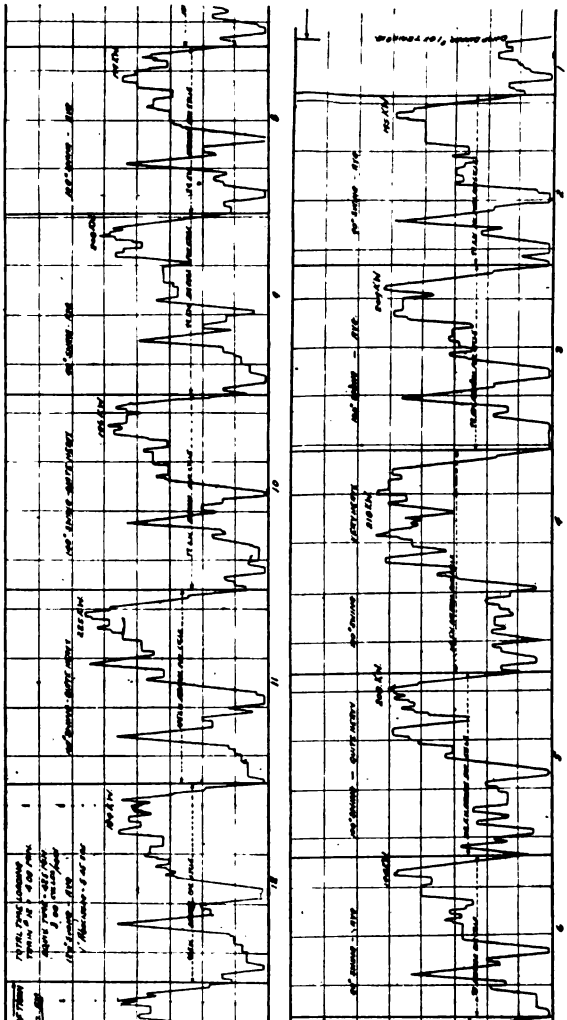


FIG. 36. CURVE SHOWING POWER INPUT TO ELECTRIC SHOVEL

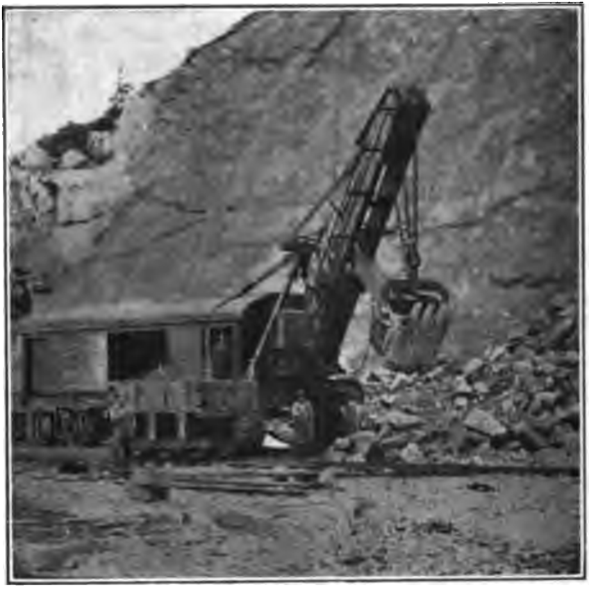


FIG. 37. 70-CYCLE BUCYRUS ELECTRIC SHOVEL AT WORK IN GRANITE QUARRY, BURRARDO INLET, B. C.

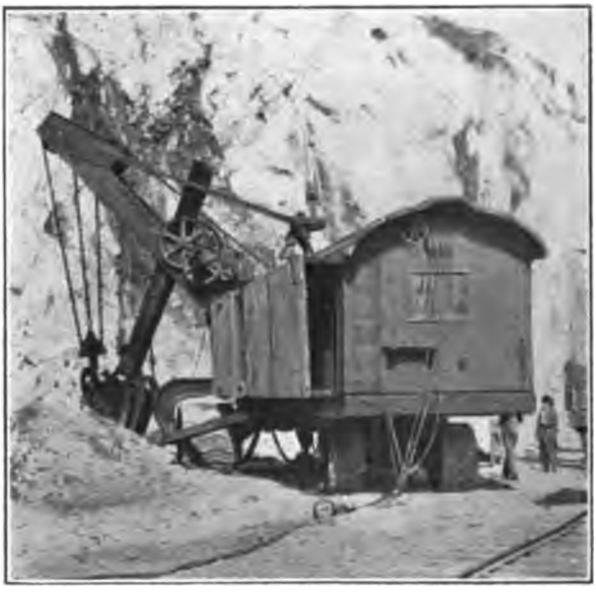


FIG. 38. REAR VIEW OF 70-CYCLE BUCYRUS ELECTRIC SHOVEL SHOWN IN FIG. 37

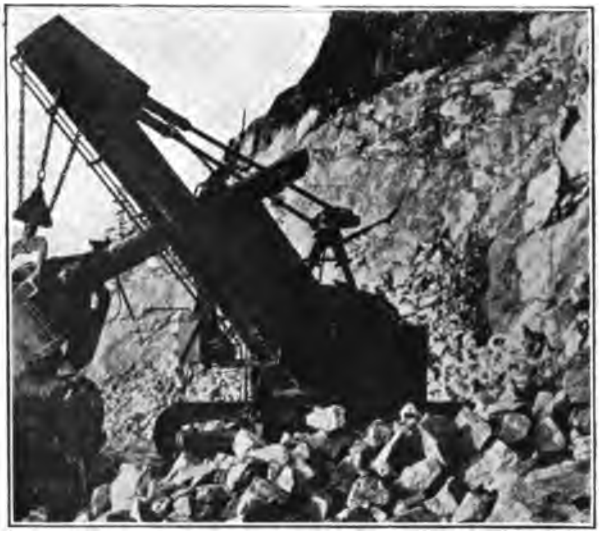


Fig. 39. Electric Shovel Under Heavy Service Conditions

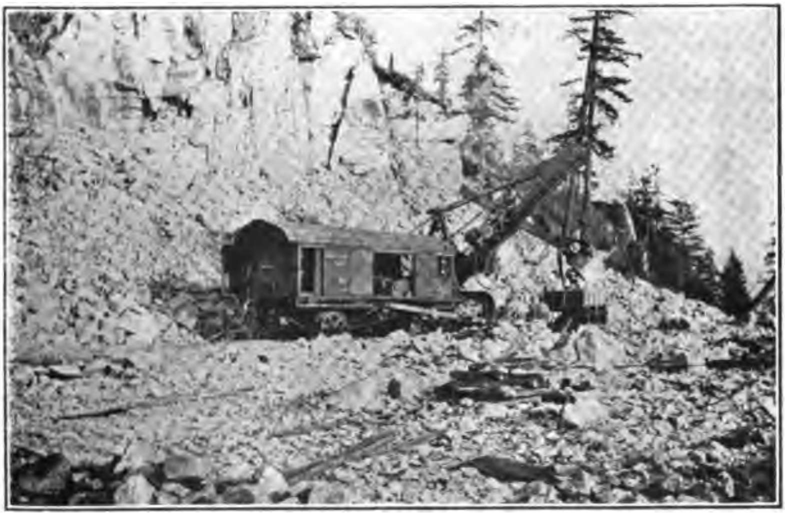


Fig. 40. Electric Shovel Operating in a Stone Quarry

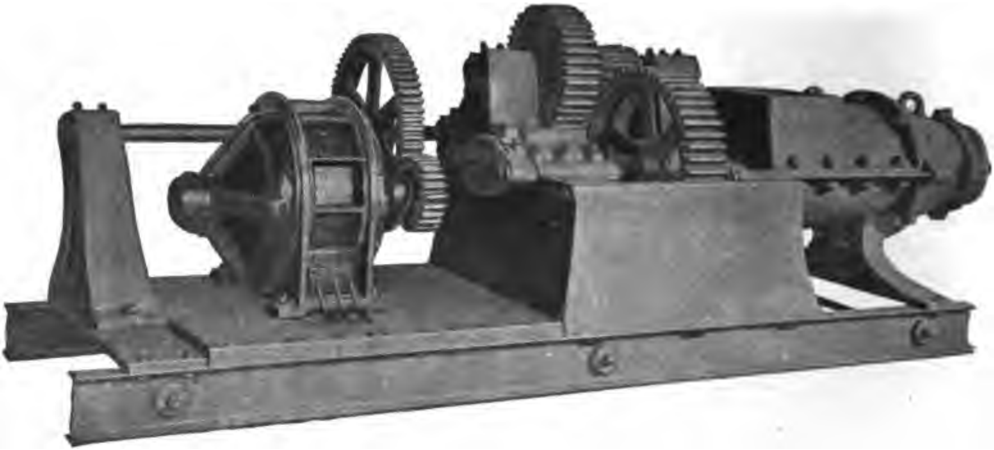


FIG. 41. MOTOR-DRIVEN BRICK MACHINE

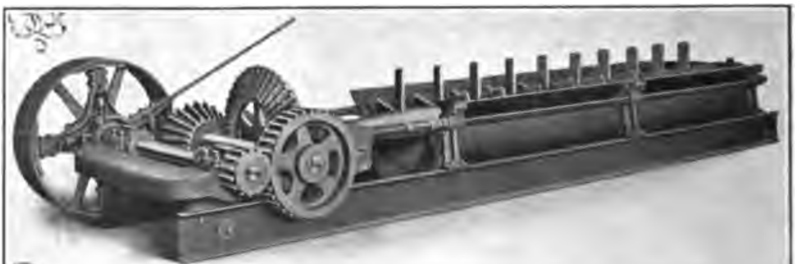


FIG. 42. GRANULATOR ARRANGED FOR BELT DRIVE

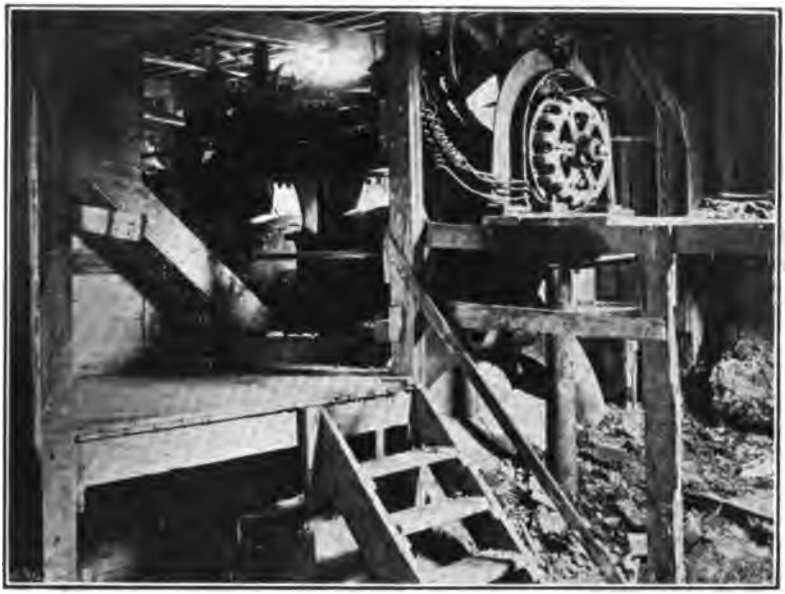


FIG. 43. DRY PAN DRIVEN BY WESTINGHOUSE INDUCTION MOTOR

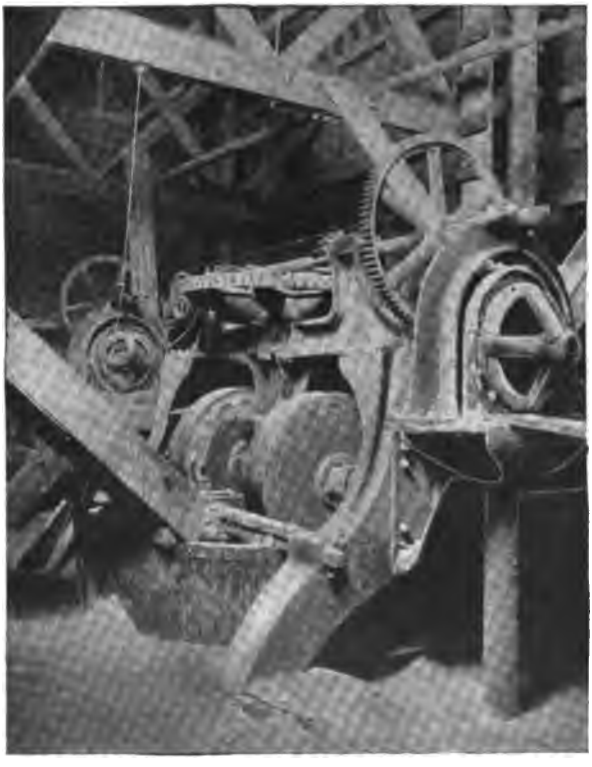


FIG. 44. DRY PAN

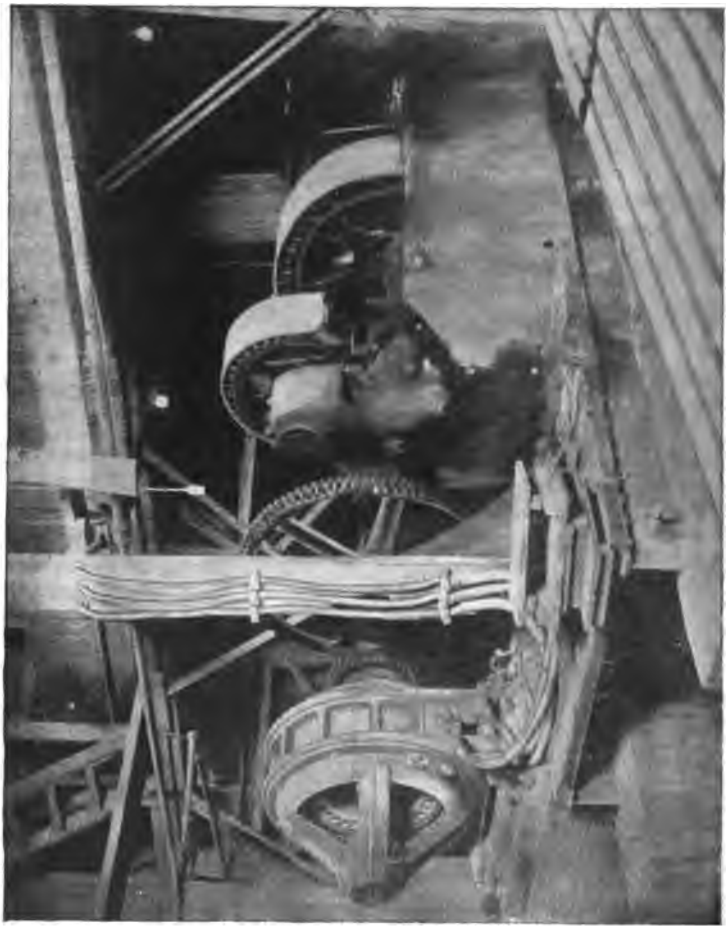


Fig. 45. Motor-Driven Brick Machine

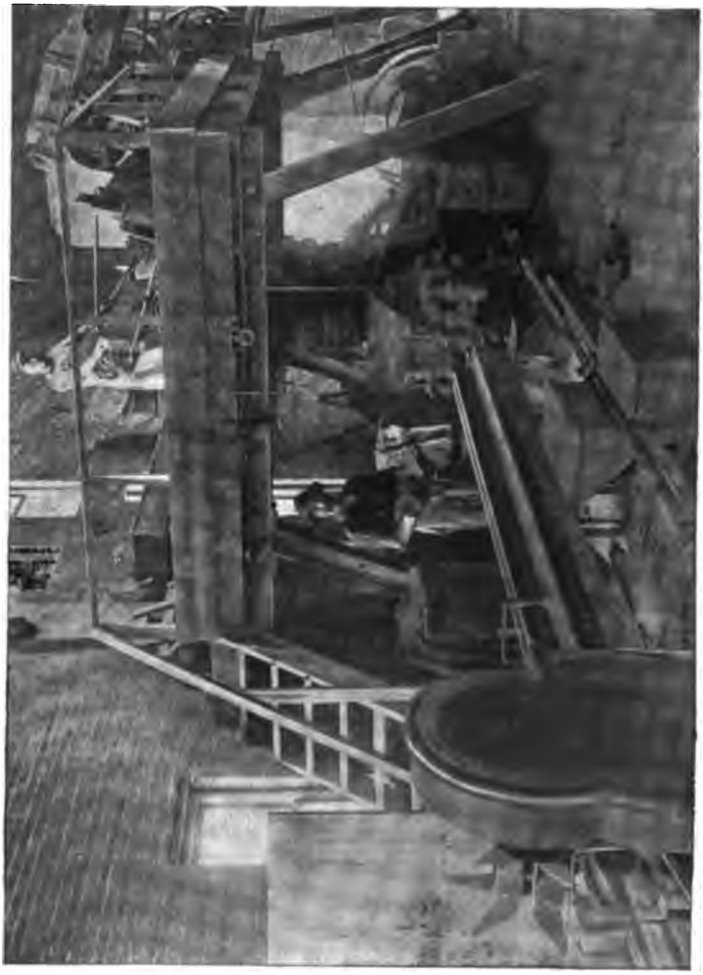


Fig. 46. Motor-Driven Brick Machine

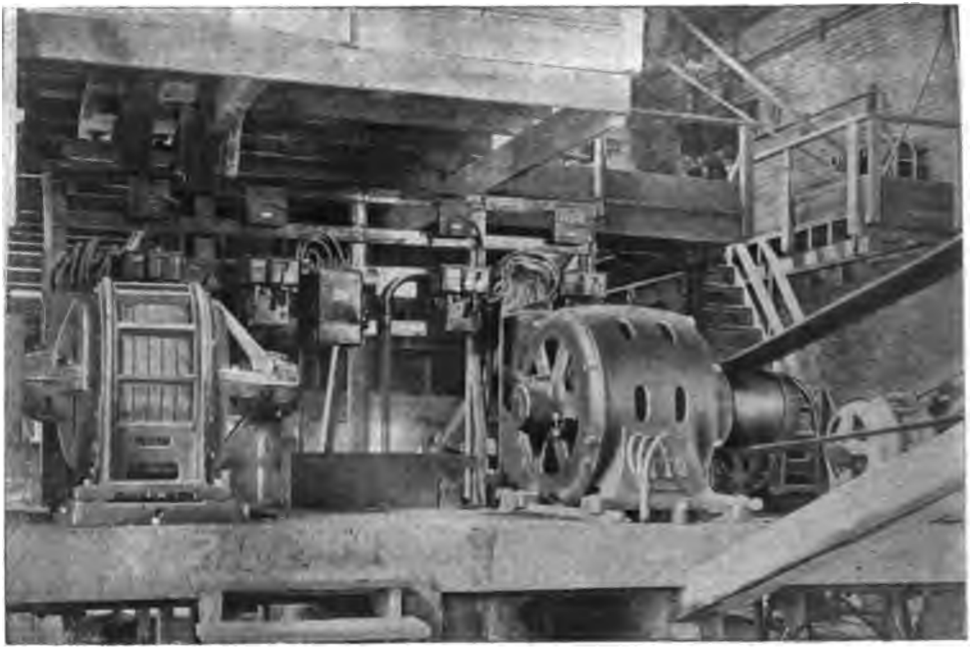


FIG. 47. GROUP OF ELECTRIC MOTORS

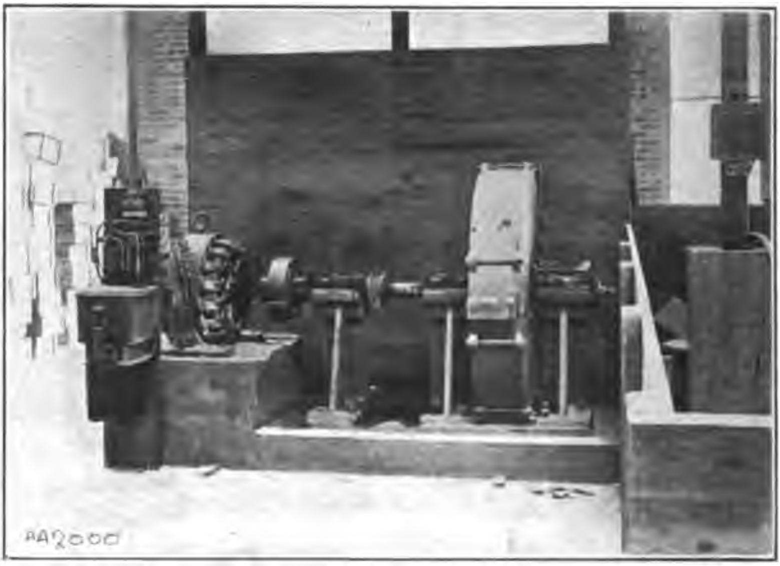


FIG. 48. DUST MACHINE IN A POTTERY PLANT DIRECT-COUPLED TO A WESTINGHOUSE, SQUIRREL CAGE, INDUCTION MOTOR

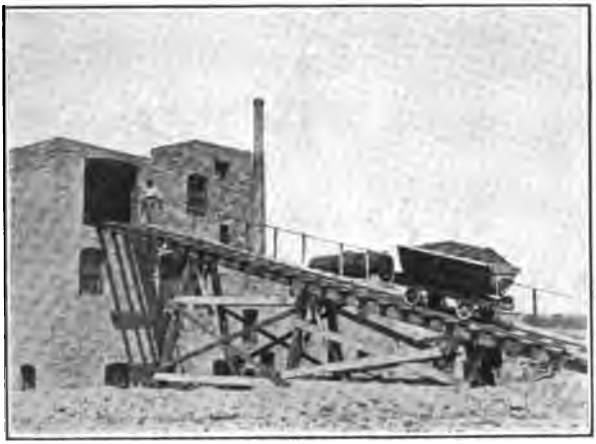


FIG. 49. HANDLING CLAY CAR UP FROM CLAY PIT

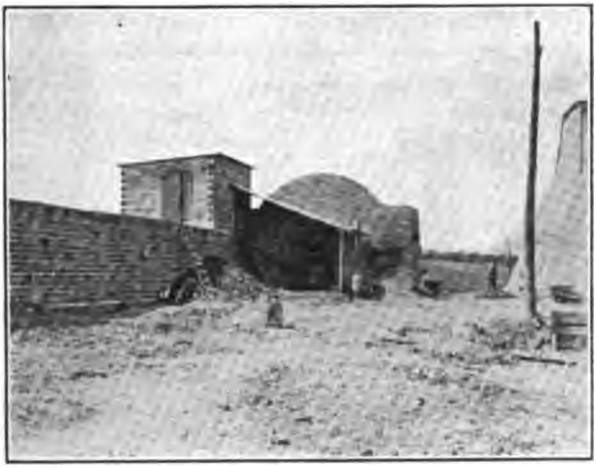


FIG. 50. FAN HOUSE, FAN HANDLING WASTE HEAT GASES FROM BURNING KILN

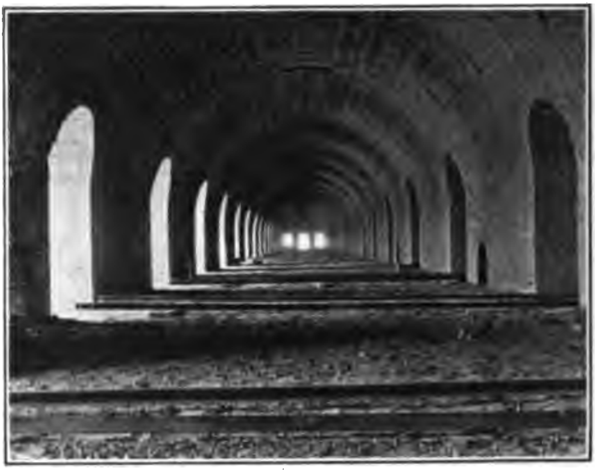


Fig. 51. Interior of Permanent Burning Kiln, Arranged to Deliver Waste Heat Gases to Tunnel Underneath—Kiln Just Completed

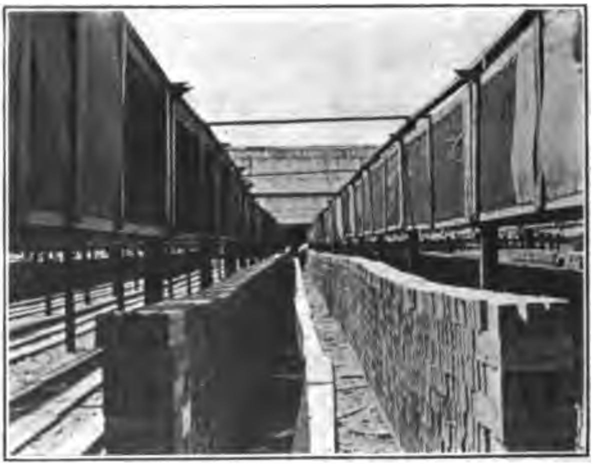


Fig. 52. Sun Drying Brick. Note the Adjustable Roof Sections That Can be Let Down Over Brick in Case of Rain

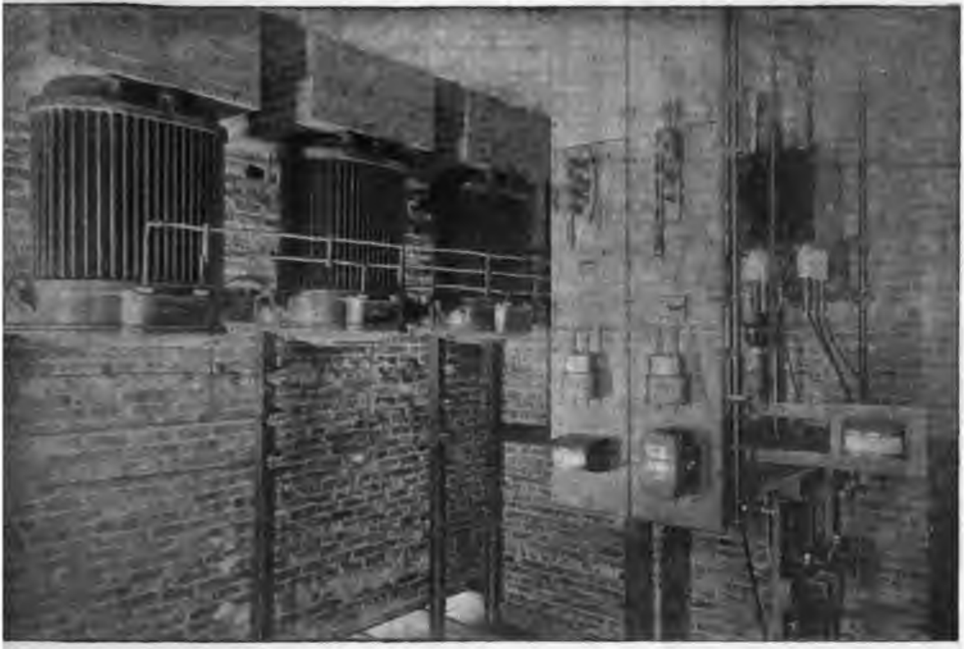


Fig. 53. Transformer Sub-Station

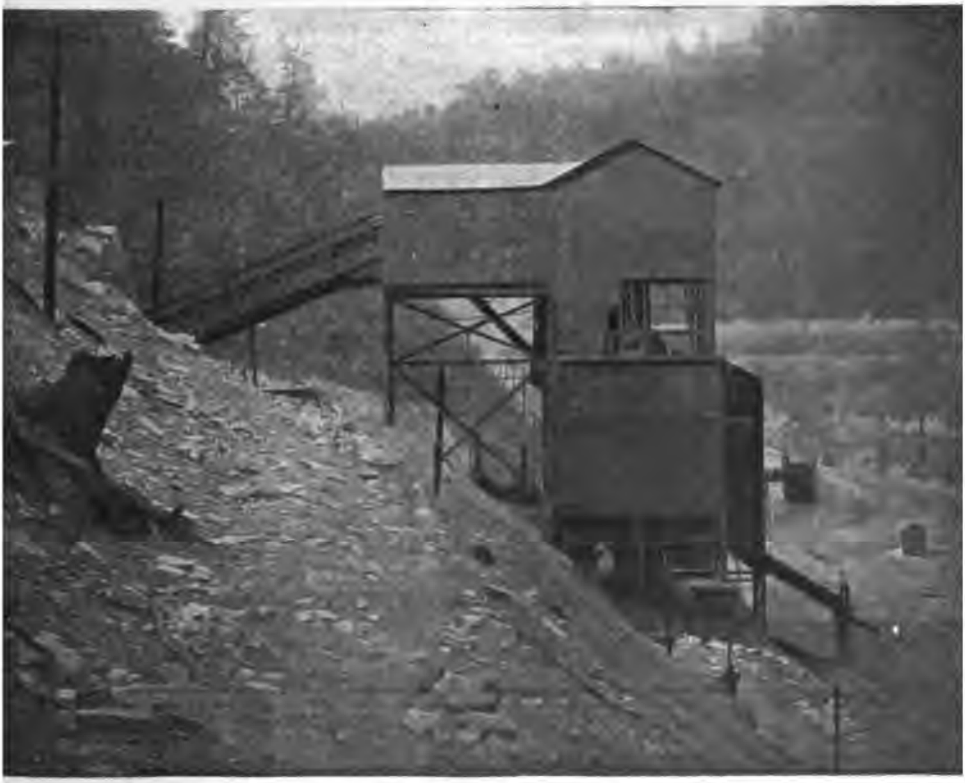


Fig. 54. Tipple and Screen House

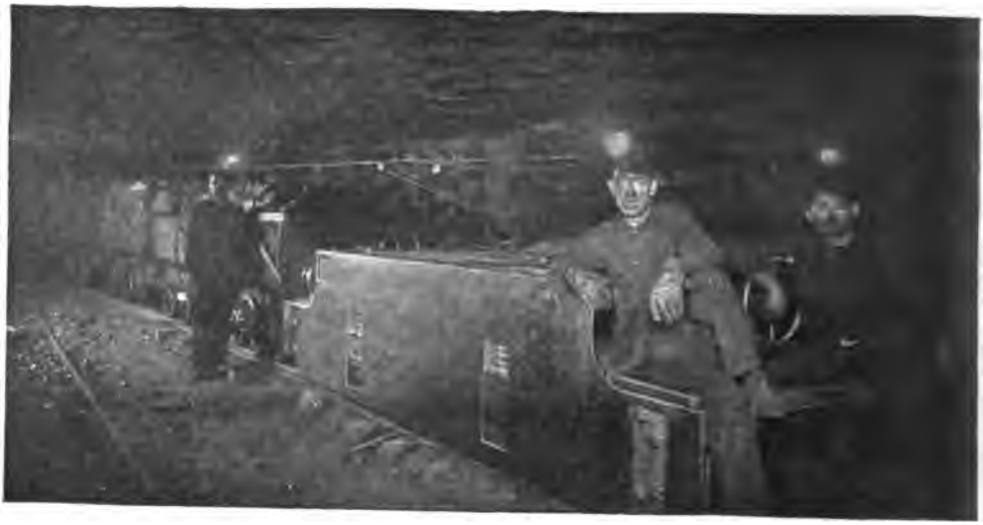


FIG. 55. MINE LOCOMOTIVE

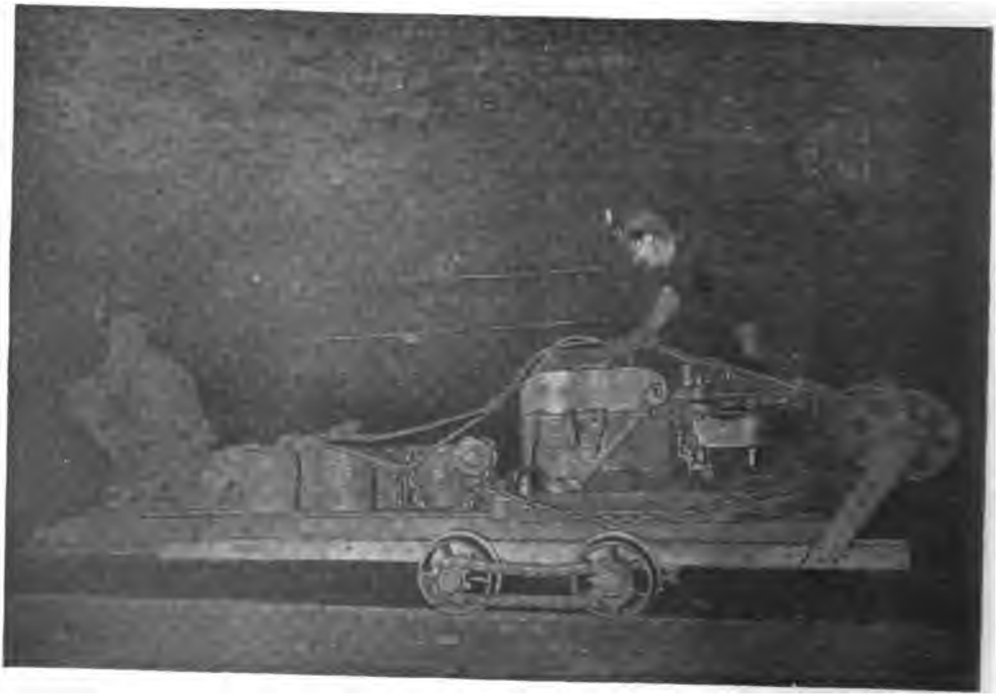


FIG. 56. COAL CUTTING MACHINE

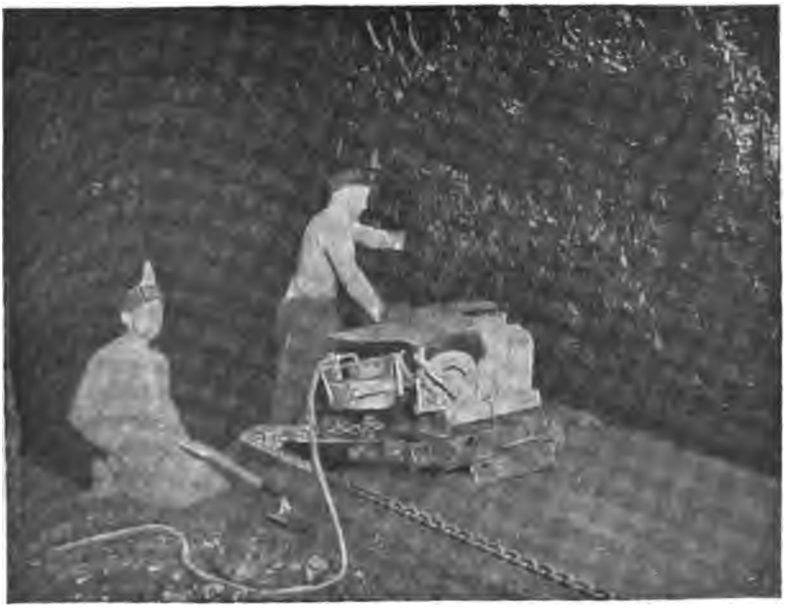


Fig. 57. Coal Cutting Machine

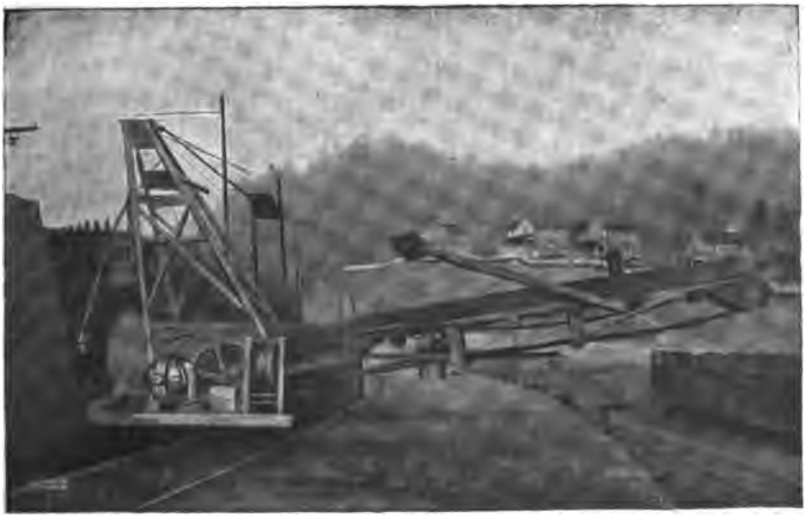


Fig. 58. Coke Extractor

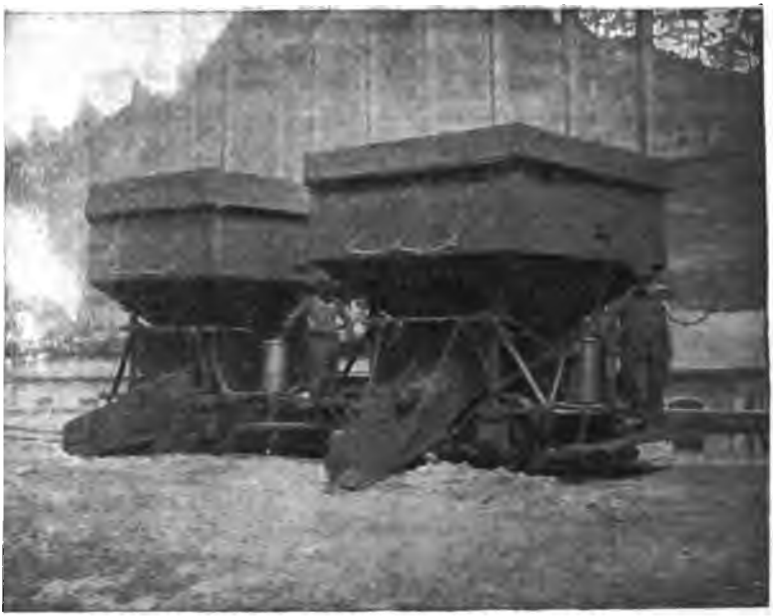


FIG. 59. LARRY CARS

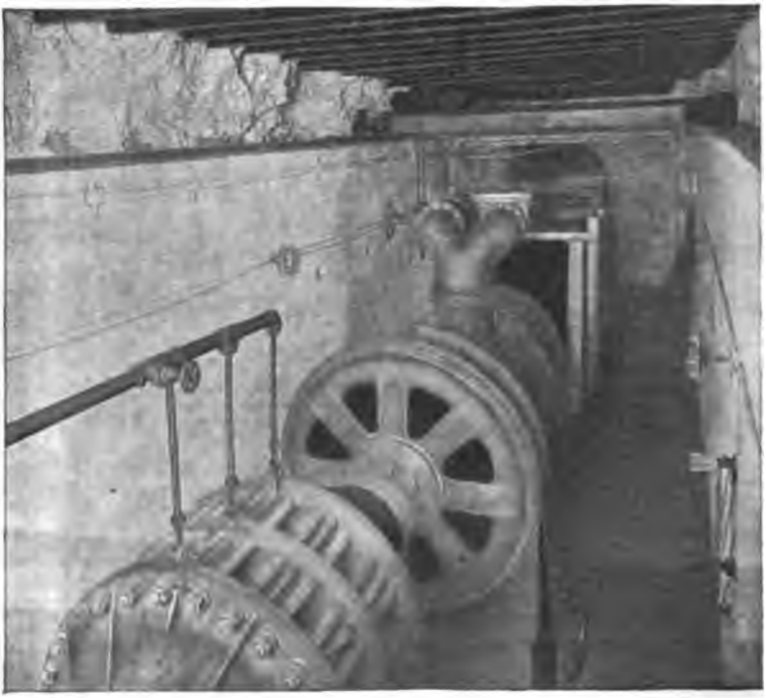


FIG. 60. MOTOR-DRIVEN PUMP

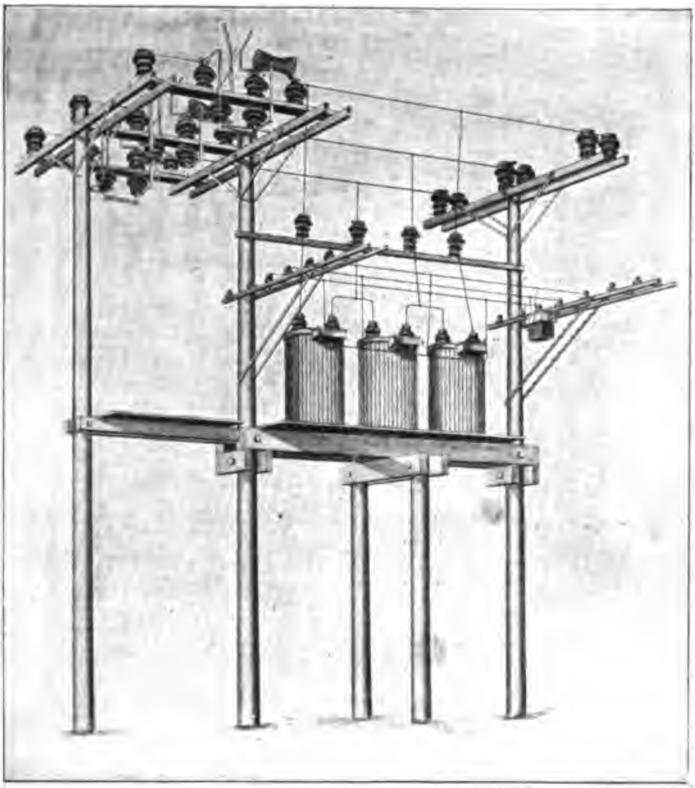


FIG. 61. OUTDOOR SUB-STATION

FIG. 62. INSULATED HOOK STICK

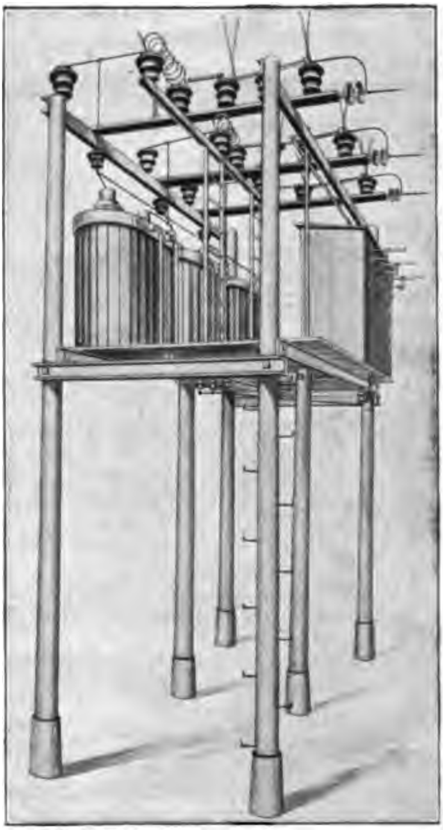


Fig. 63. Outdoor Sub-Station

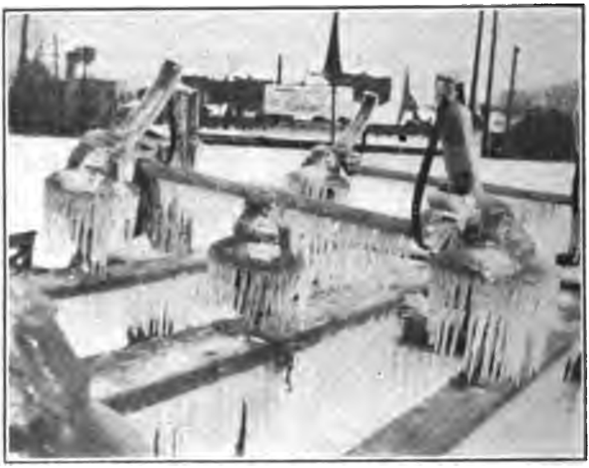


Fig. 64. Ice Formation on Pole Top Switch

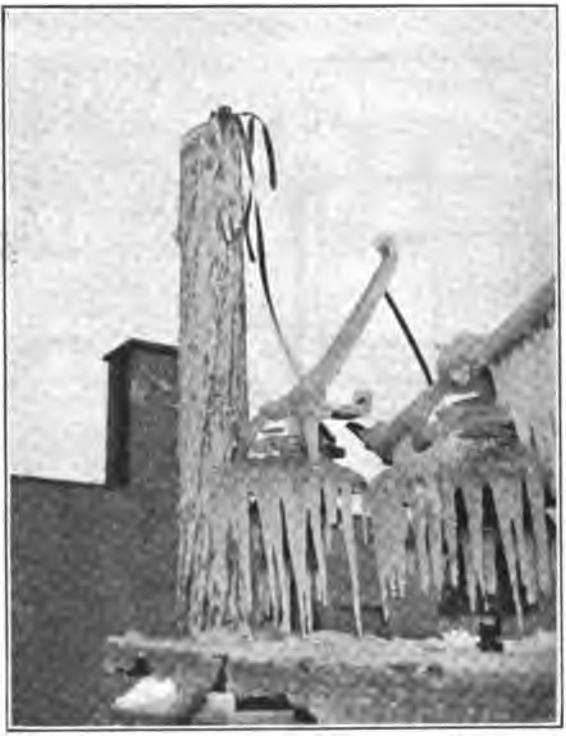


FIG. 65. ICE FORMATION ON POLE TOP SWITCH

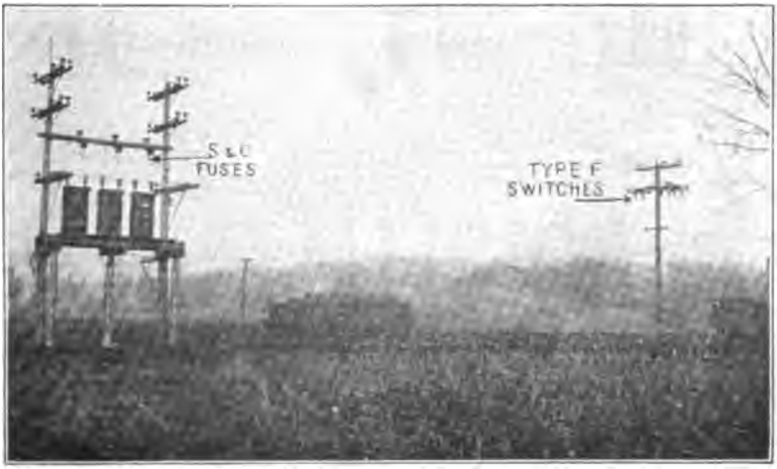


FIG. 66. OUTDOOR SUB-STATION

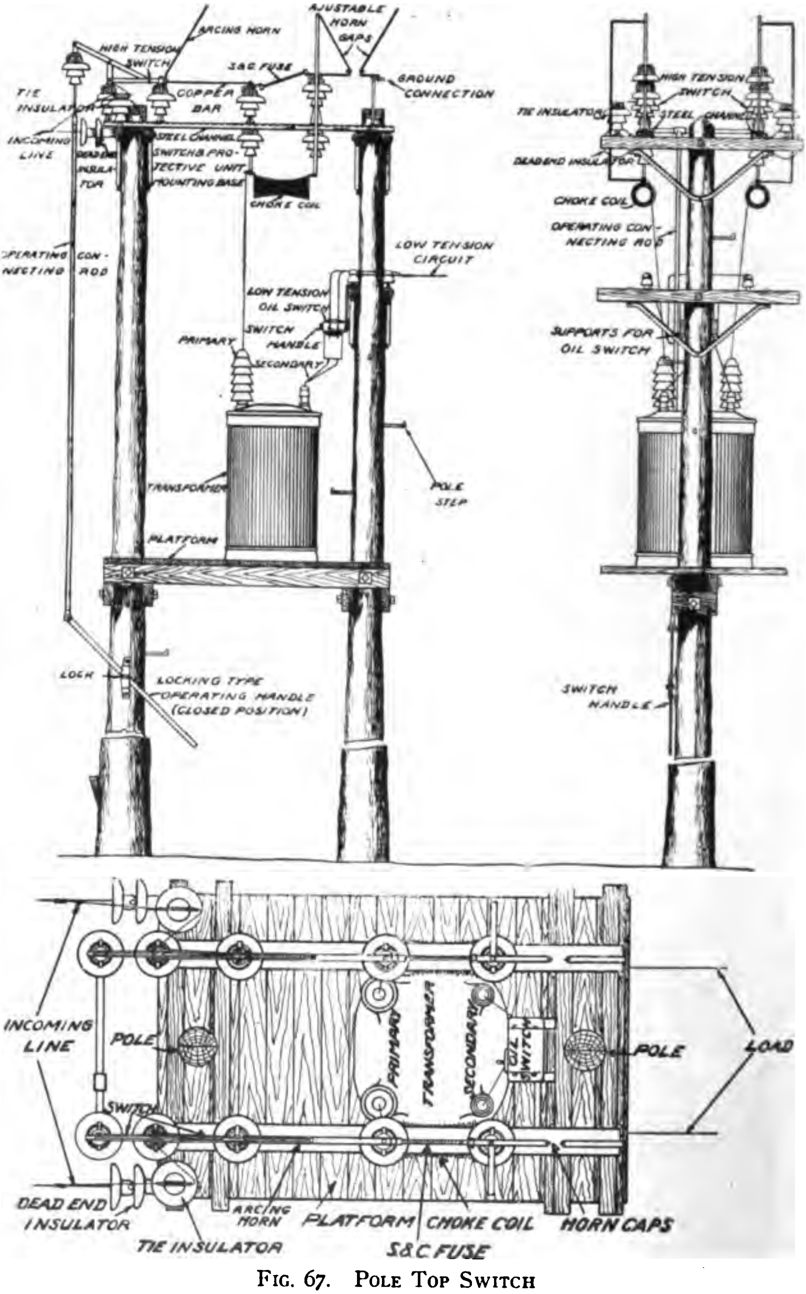
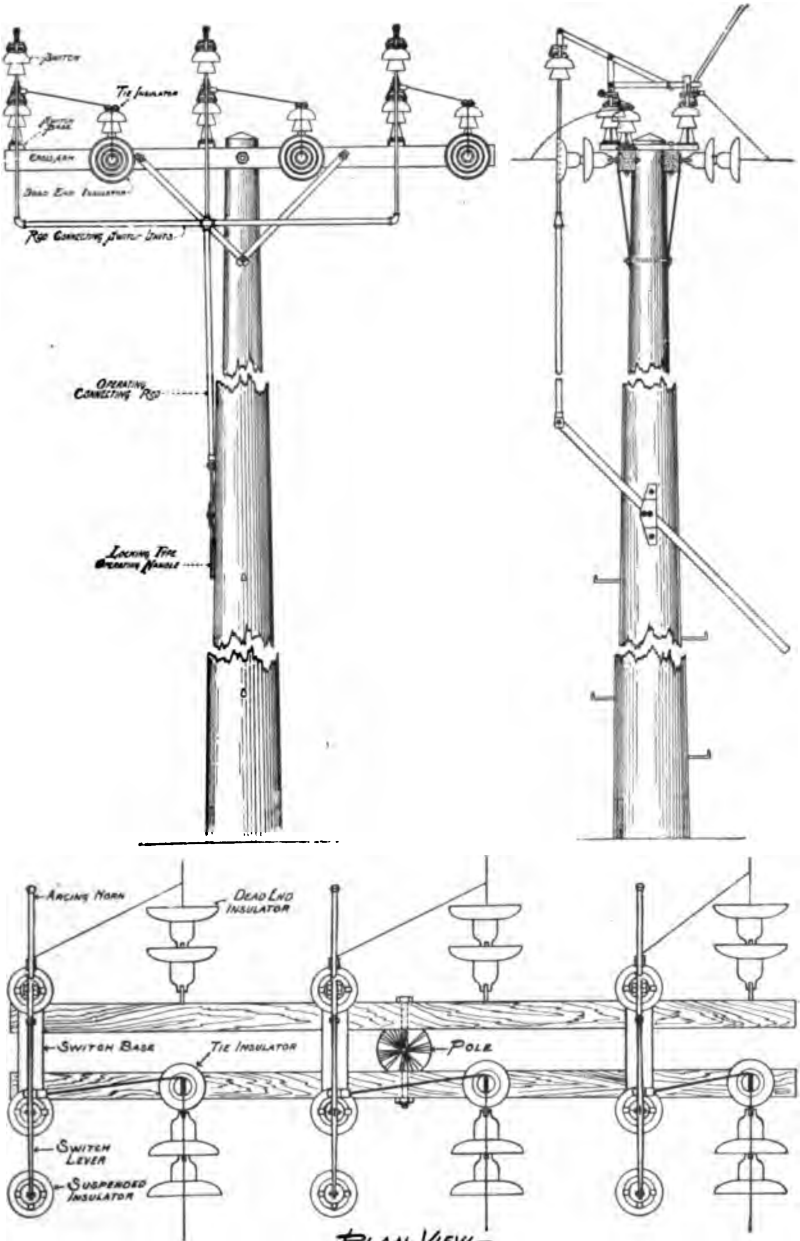


FIG. 67. POLE TOP SWITCH



-PLAN VIEW-

FIG. 68. POLE TOP SWITCH

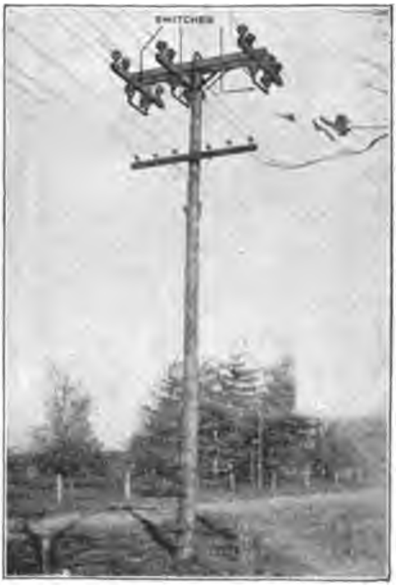


Fig. 69. Disconnecting Switches on Pole

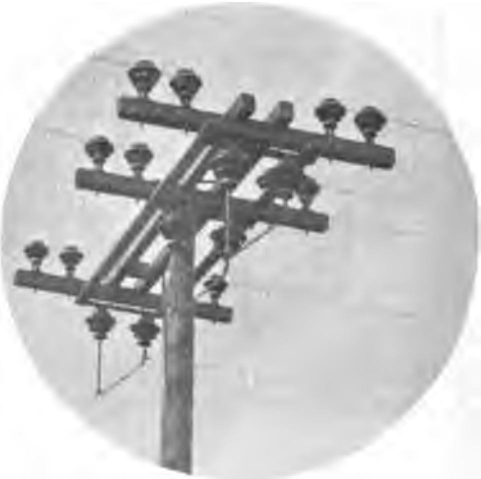


Fig. 70. Carbon-Tetrachloride Fuse on Separate Pole. Capacity 10 Amperes 33,000 Volts

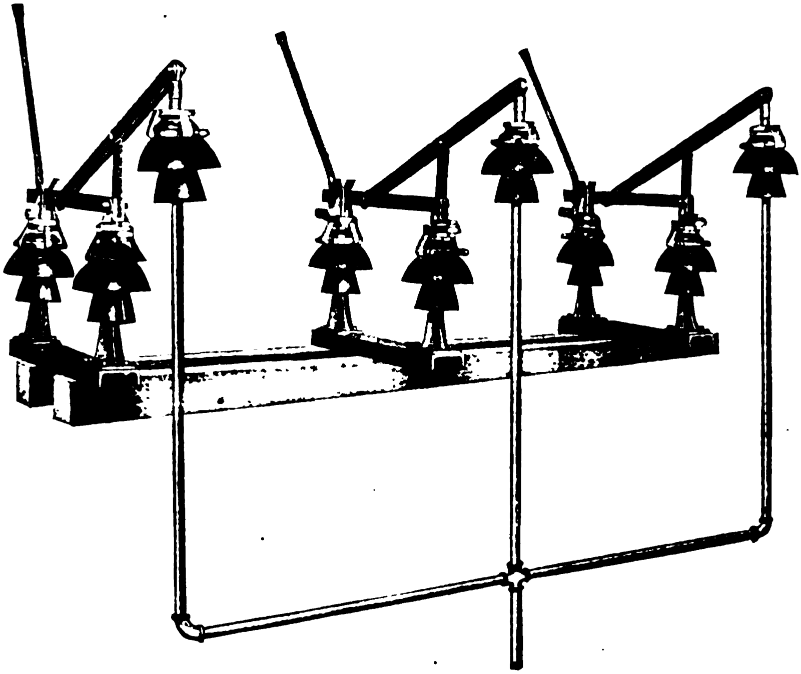


FIG. 71. OUTDOOR SUB-STATION

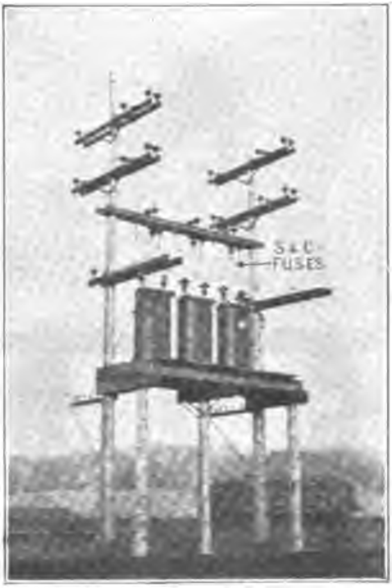


FIG. 72. OUTDOOR SUB-STATION

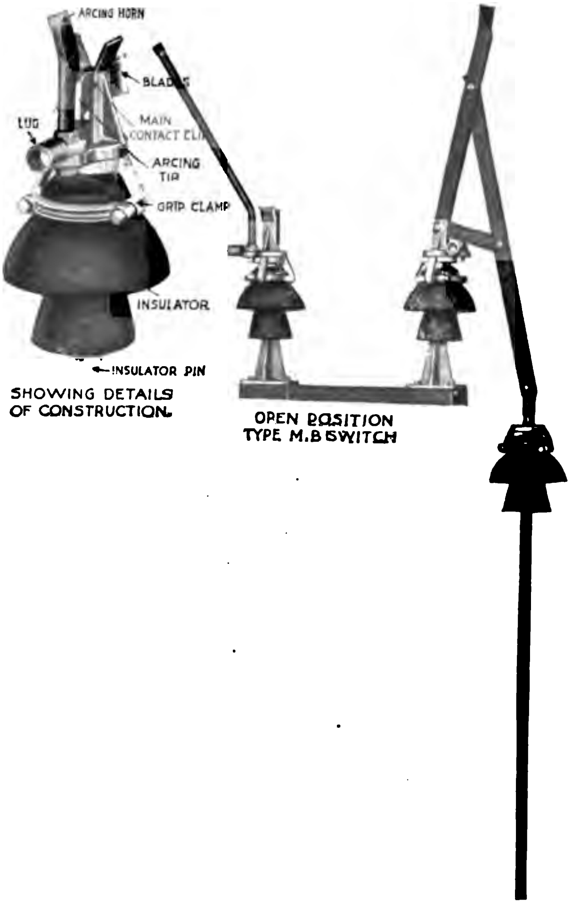


Fig. 73. Pole Top Switch

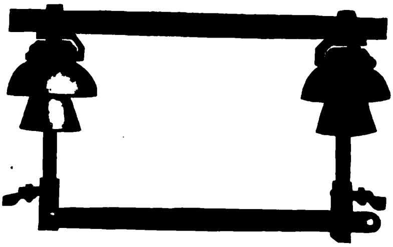


Fig. 74. Disconnecting Switch

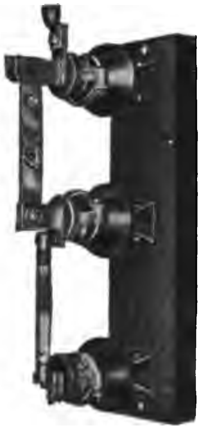


FIG. 75 DISCONNECTING SWITCH AND FUSE

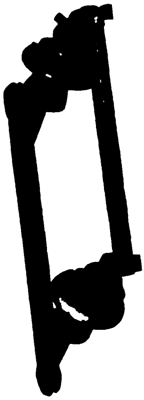


FIG. 76. POLE TOP FUSE

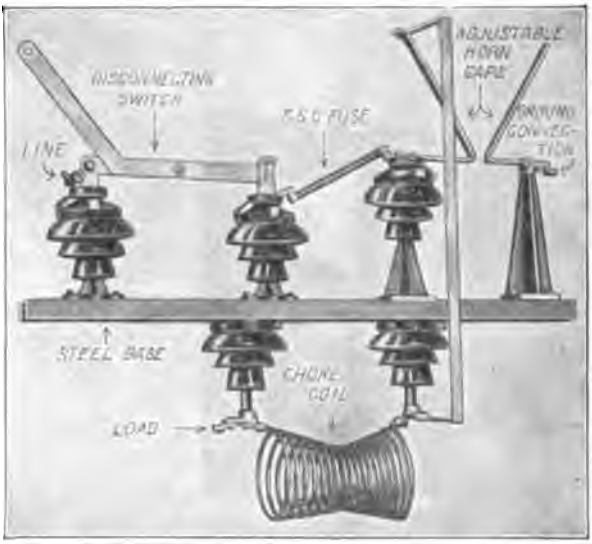


FIG. 77. DISCONNECTING SWITCH, FUSE AND CHOKE COIL

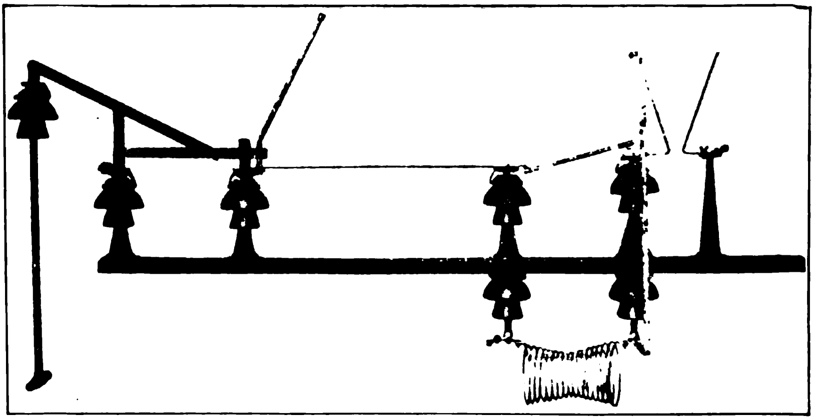


FIG. 78. SWITCH, FUSE AND HORN GAP

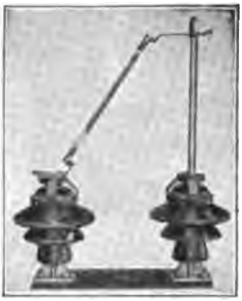


Fig. 79. Fuse for Cross-Arm

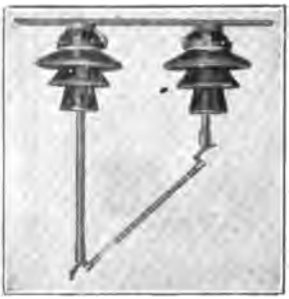


Fig. 80. Fuse for Cross-Arm

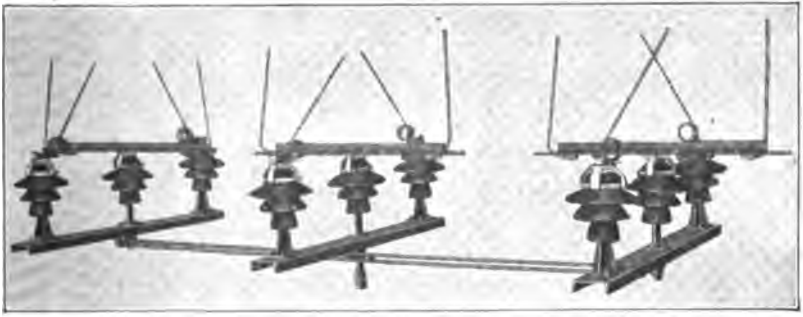
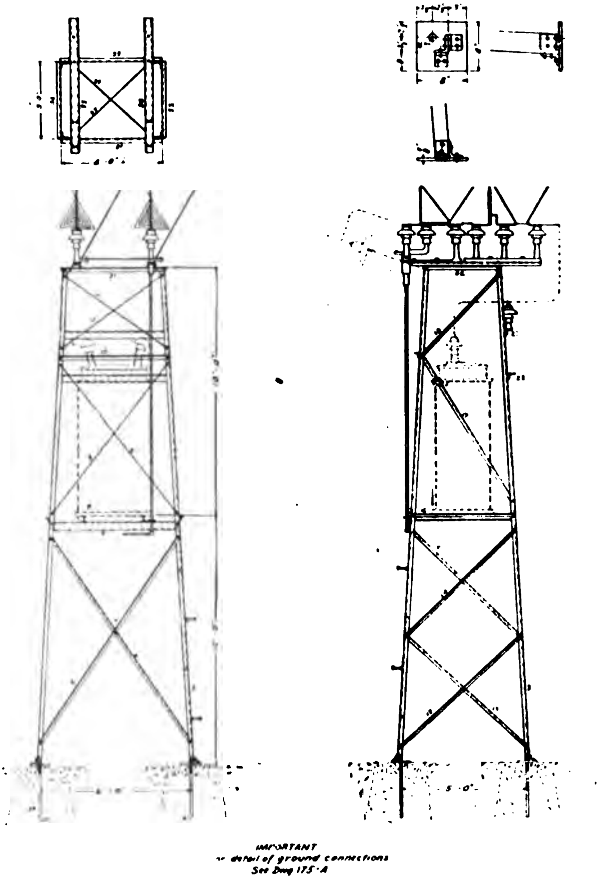


Fig. 81. Weather-proof Transformer



IMPORTANT
for detail of ground connections
See Dwg 175-A

FIG. 82. STEEL WORK FOR OUTDOOR SUB-STATION

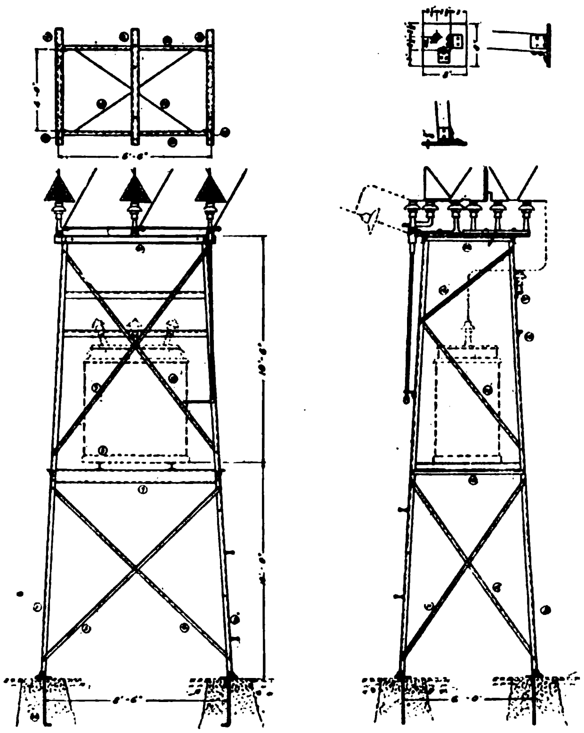


Fig. 83. Steel Work for Outdoor Sub-Station

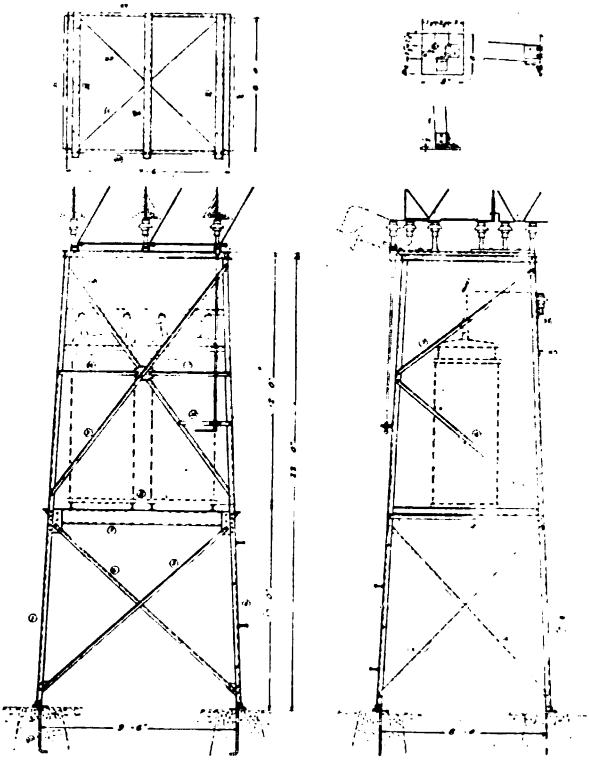


FIG. 84. STEEL WORK FOR OUTDOOR SUB-STATION

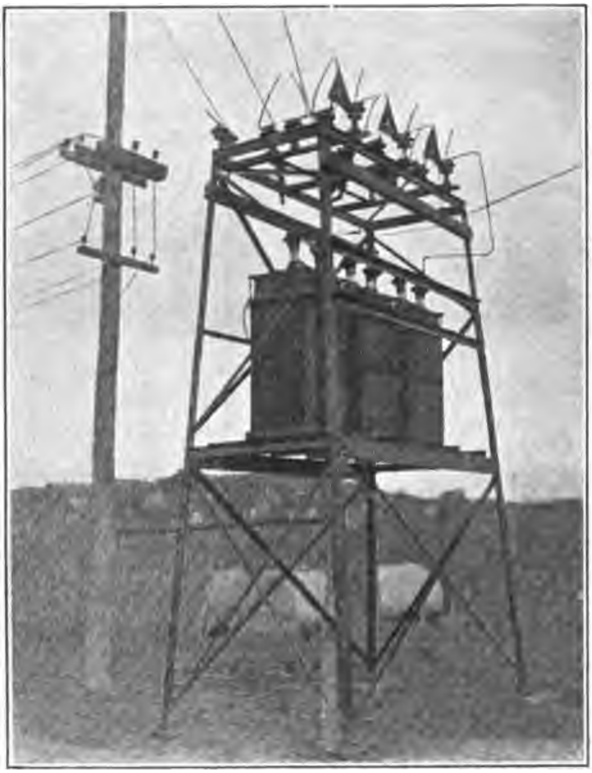


FIG. 85. OUTDOOR-TYPE STEEL SUB-STATION, MODEL D. TRANSMISSION ENGINEERING CO.

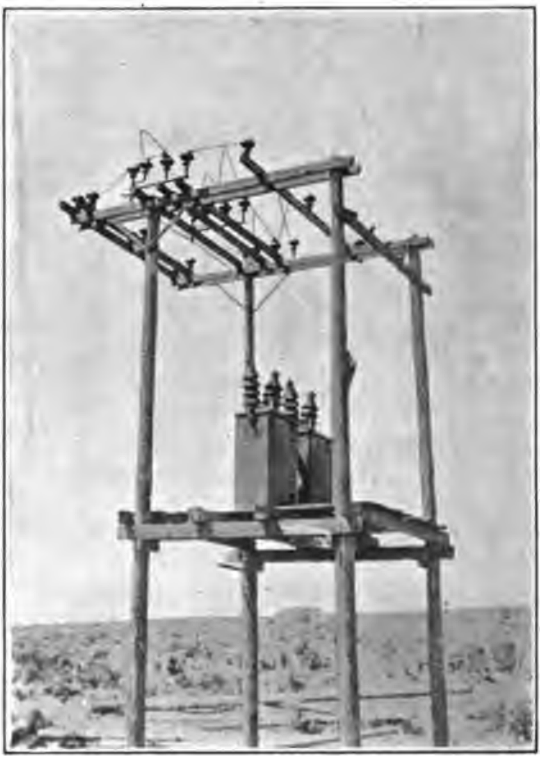


FIG. 86. 150-KV-A., 44,000-VOLT, SUB-STATION. RAILWAY & INDUSTRIAL ENGINEERING CO.

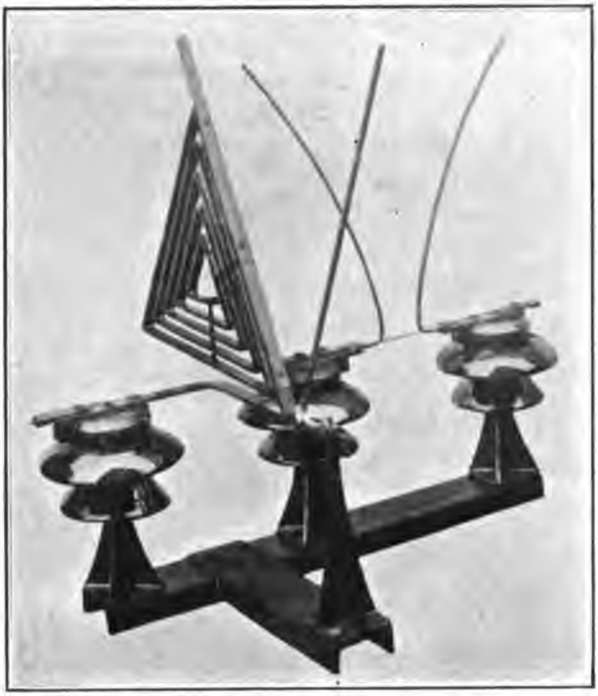


FIG. 87. COMBINATION LIGHTNING ARRESTER AND FUSE 35,000-VOLT, SINGLE-POLE UNIT. RAILWAY & INDUSTRIAL ENGINEERING CO.

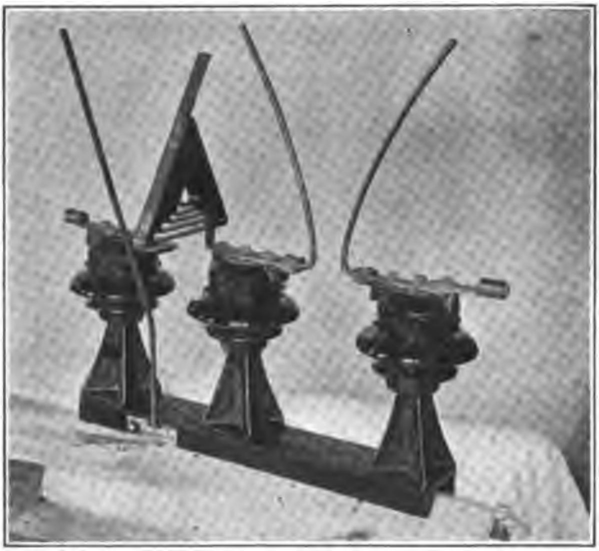


FIG. 88. COMBINATION LIGHTNING ARRESTER, CHOICE COIL AND FUSE. RAILWAY & INDUSTRIAL ENGINEERING CO.

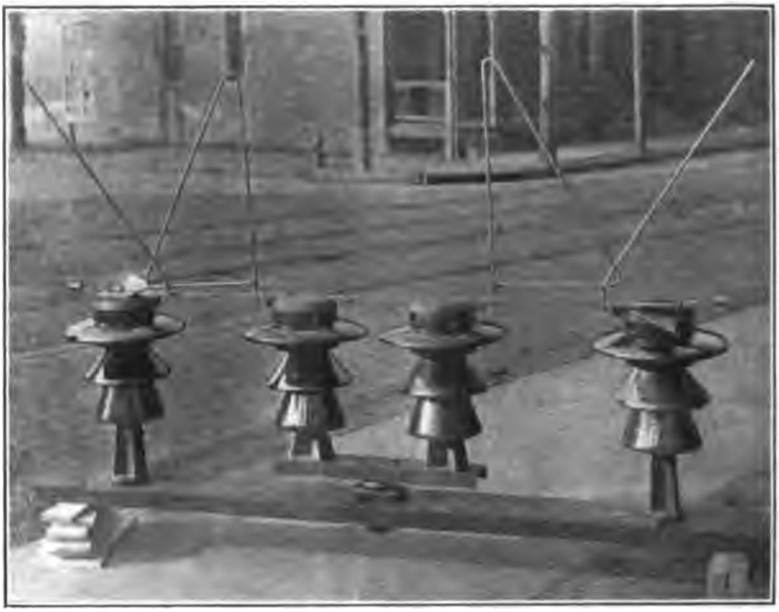


FIG. 89. 66,000-VOLT, SINGLE-POLE, DOUBLE-BREAK SWITCH. RAILWAY & INDUSTRIAL ENGINEERING CO.

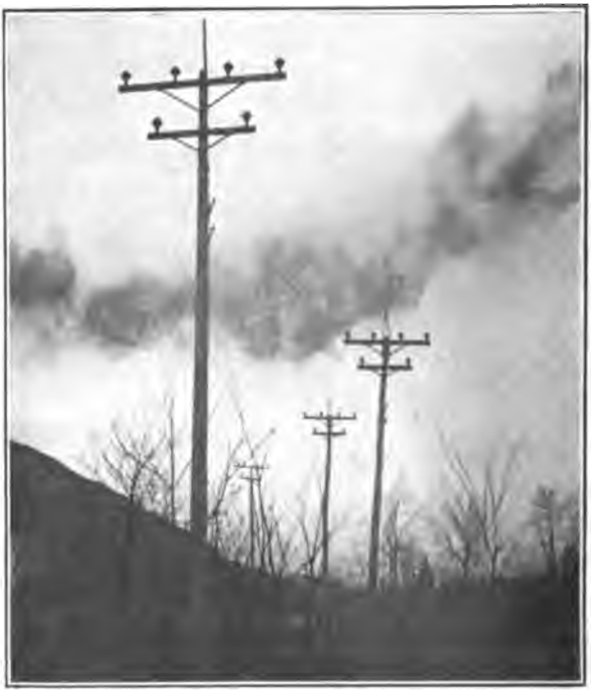


FIG. 90. 33,000-VOLT LINE WITH OVERHEAD GROUND WIRE AND PRIVATE TELEPHONE LINE ON BRACKETS

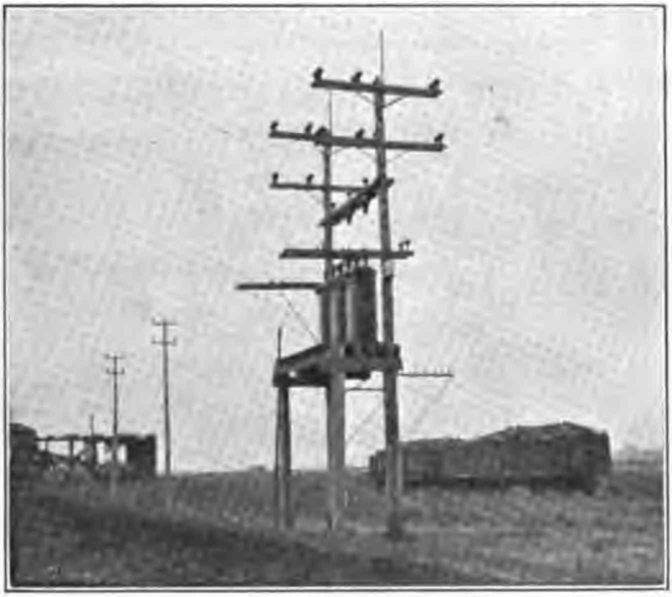


FIG. 91. TRANSFORMER INSTALLATION ON 33,000-VOLT LINE, SHOWING OVERHEAD GROUND WIRE SUPPORTED ON ANGLE IRON AND CLASS B CONSTRUCTION B IN THE DISTANCE

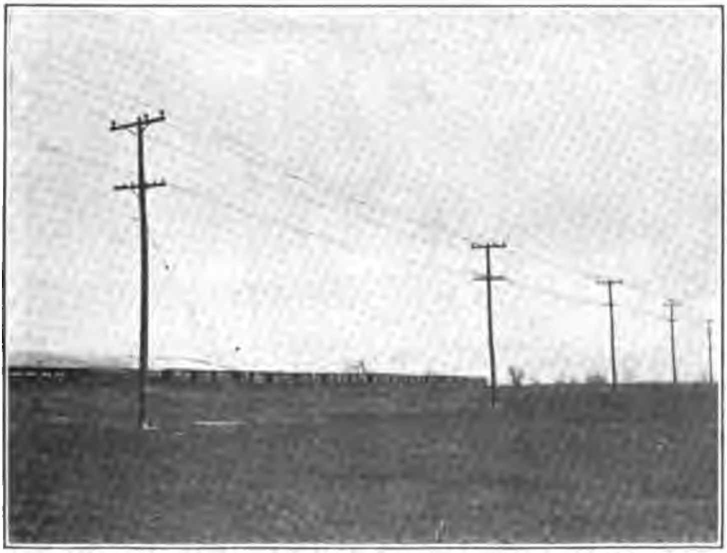


FIG. 92. HIGH-TENSION LINE WITH DISTRIBUTION LINE UNDERNEATH

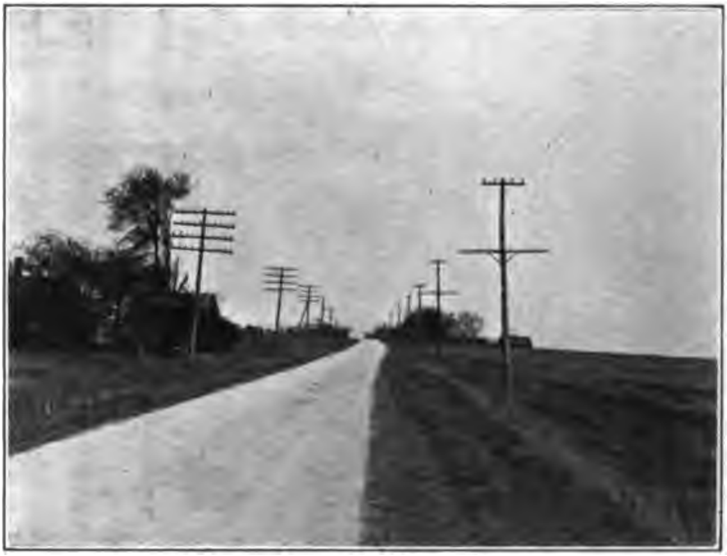


FIG. 93. COMBINATION DISTRIBUTION LINE OF CENTRAL-STATION COMPANY AND TELEPHONE LINE

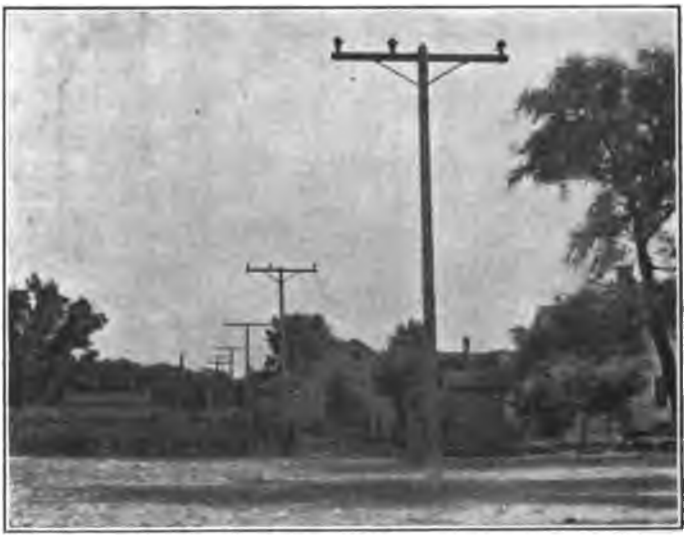


FIG. 94. 33,000-VOLT TRANSMISSION LINE USING CONCRETE POLES

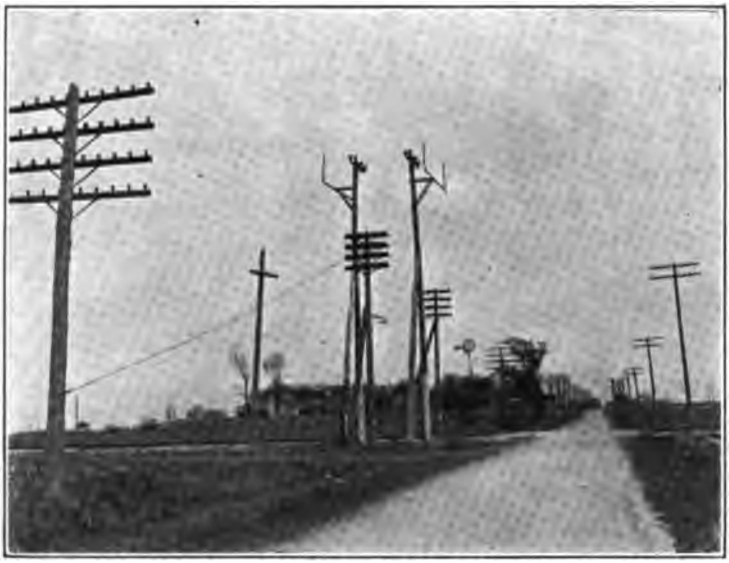


FIG. 95. SHORT SPAN CROSSING OF HIGH-TENSION LINE OVER LONG DISTANCE TELEPHONE LINE

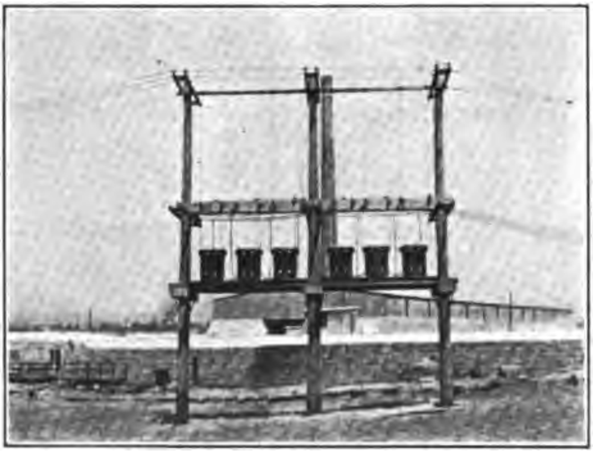


FIG. 96. A TRANSFORMER INSTALLATION OF WHICH THE LINE GANG MAY WELL BE PROUD

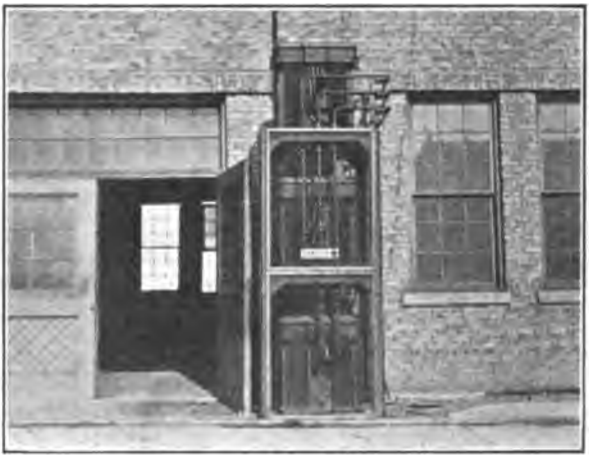
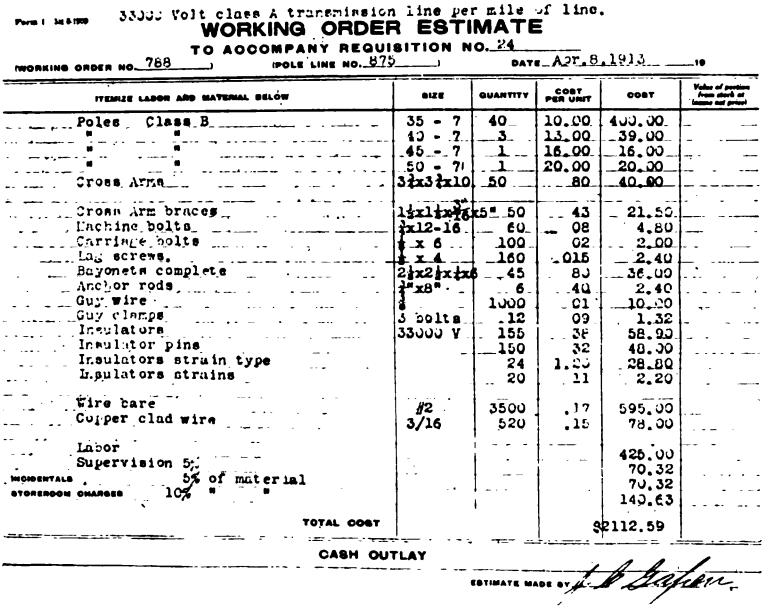


FIG. 97. TRANSFORMER SET ON STEEL FRAME-WORK—DISTRIBUTION LINE COMES IN UNDERGROUND



Form 1 33000 Volt class A transmission line per mile of line.

WORKING ORDER ESTIMATE

TO ACCOMPANY REQUISITION NO. 24

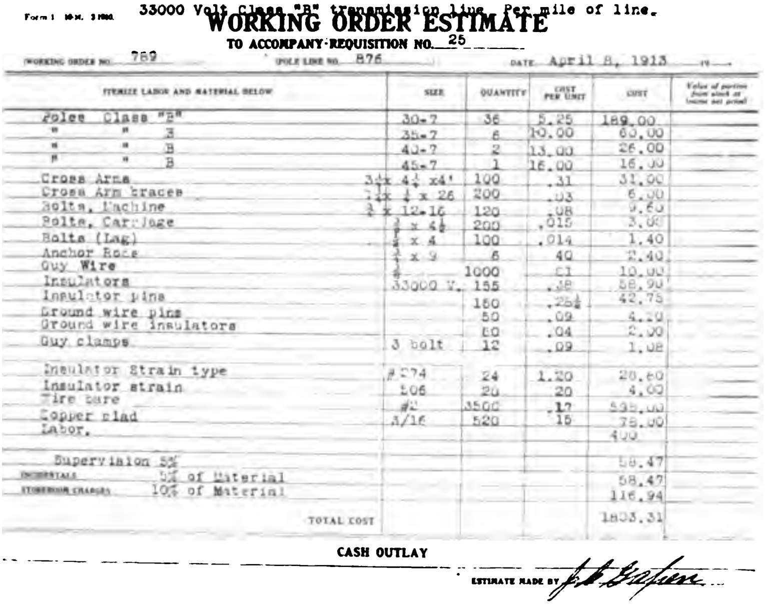
(WORKING ORDER NO. 788) (POLE LINE NO. 875) DATE Apr. 8, 1913 19

ITEMIZE LABOR AND MATERIAL BELOW	SIZE	QUANTITY	COST PER UNIT	COST	Value of portion from stock at (some est price)
Poles Class B	35 - 7	40	10.00	400.00	
" "	40 - 7	3	13.00	39.00	
" "	45 - 7	1	16.00	16.00	
" "	50 - 7'	1	20.00	20.00	
Cross Arms	3¼x3¼x10	50	.80	40.00	
Cross Arm braces	1¼x1¼x3/16x5"	50	.43	21.50	
Machine bolts	¾x12-16	60	.08	4.80	
Carriage bolts	⅜ x 6	100	.02	2.00	
Lag screws.	½ x 4	160	.015	2.40	
Bayonets complete	2½x2½x¼x6	45	.80	36.00	
Anchor rods	¾"x8"	6	.40	2.40	
Guy wire	⅜	1000	.01	10.00	
Guy clamps	3 bolts	12	.09	1.32	
Insulators	33000 V	155	.38	58.90	
Insulator pins		150	.32	48.00	
Insulators strain type		24	1.20	28.80	
Insulators strains		20	.11	2.20	
Wire bare	#2	3500	.17	595.00	
Copper clad wire	3/16	520	.15	78.00	
Labor				425.00	
Supervision 5%				70.32	
INCIDENTALS 5% of material				70.32	
STOREROOM CHARGES 10% " "				140.63	
TOTAL COST				$2112.59	

CASH OUTLAY

ESTIMATE MADE BY

Fig. 98. Estimate of Cost of Transmission Line



Form 1 33000 Volt Class "B" transmission line Per mile of line.

WORKING ORDER ESTIMATE

TO ACCOMPANY REQUISITION NO. 25

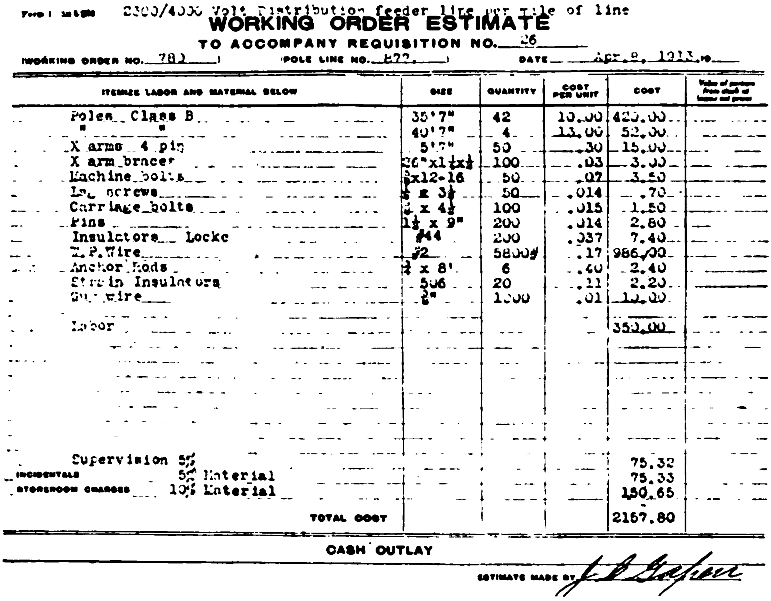
(WORKING ORDER NO. 789 (POLE LINE NO. 876 DATE April 8, 1913 19

ITEMIZE LABOR AND MATERIAL BELOW	SIZE	QUANTITY	COST PER UNIT	COST	Value of portion from stock at (some est price)
Poles Class "B"	30-7	36	5.25	189.00	
" " B	35-7	6	10.00	60.00	
" " B	40-7	2	13.00	26.00	
" " B	45-7	1	16.00	16.00	
Cross Arms	3¼ x 4¼ x4'	100	.31	31.00	
Cross Arm braces	1¼ x ¼ x 26	200	.03	6.00	
Bolts, Machine	⅝ x 12-16	120	.08	9.60	
Bolts, Carriage	⅜ x 4½	200	.015	3.00	
Bolts (Lag)	½ x 4	100	.014	1.40	
Anchor Rods	¾ x 9	6	.40	2.40	
Guy Wire	⅜	1000	.01	10.00	
Insulators	33000 V.	155	.38	58.90	
Insulator pins		150	.28½	42.75	
Ground wire pins		50	.09	4.20	
Ground wire insulators		50	.04	2.00	
Guy clamps	3 bolt	12	.09	1.08	
Insulator Strain type	#274	24	1.20	28.80	
Insulator strain	506	20	.20	4.00	
Wire bare	#2	3500	.17	595.00	
Copper clad	3/16	520	.15	78.00	
Labor.				400	
Supervision 5%				58.47	
INCIDENTALS 5% of Material				58.47	
STOREROOM CHARGES 10% of Material				116.94	
TOTAL COST				1803.31	

CASH OUTLAY

ESTIMATE MADE BY

Fig. 99. Estimate of Cost of Transmission Line



Form 1 [illegible] 2300/4000 Volt Distribution feeder line per mile of line

WORKING ORDER ESTIMATE

TO ACCOMPANY REQUISITION NO. 26

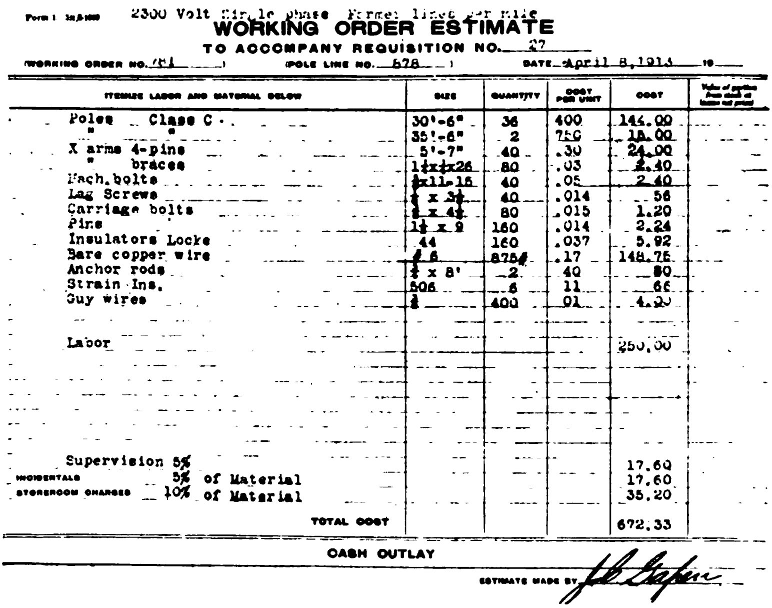
WORKING ORDER NO. 781 POLE LINE NO. 677 DATE Apr. 8, 1913

ITEMIZE LABOR AND MATERIAL BELOW	SIZE	QUANTITY	COST PER UNIT	COST	[illegible]
Poles Class B	35'7"	42	10.00	420.00	
" "	40'7"	4	13.00	52.00	
X arms 4 pin	5'7"	50	.30	15.00	
X arm braces	26"x1¼x¼	100	.03	3.00	
Machine bolts	⅝x12-16	50	.07	3.50	
Lag screws	½ x 3½	50	.014	.70	
Carriage bolts	⅜ x 4½	100	.015	1.50	
Pins	1½ x 9"	200	.014	2.80	
Insulators Locke	#44	200	.037	7.40	
W.P.Wire	#2	5800#	.17	986.00	
Anchor Rods	¾ x 8'	6	.40	2.40	
Strain Insulators	506	20	.11	2.20	
Guy wire	⅜"	1000	.01	10.00	
Labor				350.00	
Supervision 5%				75.32	
INCIDENTALS 5% Material				75.33	
STOREROOM CHARGES 10% Material				150.65	
TOTAL COST				2157.80	

CASH OUTLAY

ESTIMATE MADE BY

FIG. 100. ESTIMATED COST OF DISTRIBUTION LINE



Form 1 [illegible] 2300 Volt Single phase Farmer lines per mile

WORKING ORDER ESTIMATE

TO ACCOMPANY REQUISITION NO. 27

WORKING ORDER NO. 781 POLE LINE NO. 678 DATE April 8, 1913

ITEMIZE LABOR AND MATERIAL BELOW	SIZE	QUANTITY	COST PER UNIT	COST	[illegible]
Poles Class C	30'-6"	36	400	144.00	
" "	35'-6"	2	750	15.00	
X arms 4-pins	5'-7"	40	.30	24.00	
" braces	1¼x¼x26	80	.03	2.40	
Mach. bolts	½x11-15	40	.05	2.40	
Lag Screws	½ x 3½	40	.014	56	
Carriage bolts	⅜ x 4½	80	.015	1.20	
Pins	1½ x 9	160	.014	2.24	
Insulators Locke	44	160	.037	5.92	
Bare copper wire	# 6	875#	.17	148.75	
Anchor rods	¾ x 8'	2	40	80	
Strain Ins.	506	6	11	66	
Guy wires	⅜	400	01	4.00	
Labor				250.00	
Supervision 5%				17.60	
INCIDENTALS 5% of Material				17.60	
STOREROOM CHARGES 10% of Material				35.20	
TOTAL COST				672.33	

CASH OUTLAY

ESTIMATE MADE BY

FIG. 101. ESTIMATED COST OF SINGLE-PHASE LINE

DISCUSSION

Mr. C. P. Osborne, Portland, Ore.: I am very much interested in this Report. It covers work that we are doing at present, and while I shall tell you how we do it I want you to tell me how it should be done. We do not reach the farm because we love the farmer particularly, but because of the revenue. Our salesman is the first man to go out and he ascertains the amount of business to be done the first year. We estimate to obtain 74 per cent of the farms, 75 per cent of the residential district in the same town and all the commercial business. We make long-time contracts with small municipalities as a basis to work on. In reaching this business we always wire the houses first before entering the town with the current, so that we really wire up the maximum of the possibilities, and when the line reaches the town the meters are all put in within a day or two. This wiring is done under a regular schedule which covers the cost of wiring, and the customer is not presented with the bill until he receives his bill for the first month's service. The important point with us is to keep down the operating cost of these plants when we have them connected up, and we are now trying out a scheme of sending out an all-around man to take in the small farms and the towns by automobile. This man reads the meter, makes out the bill and collects the cash on the spot. I am not ready to report on this, as we have just begun to work it out, but I would like to hear from those who have had experience in this line. How are we going to keep the business by working it economically?

Mr. F. F. Kelly, Dayton, O.: One thing which struck me in Section II is the fact that no mention is made of securing the village lighting and pumping business as a means of making it financially possible to make extensions into rural districts. I have not been in Dayton very long, but the way it is done there I find is to pick out a good-sized village and go after the lighting and pumping contract, and we have been very successful along this line. They have at the present time about five transmission lines running out of Dayton to different villages, at distances of from five to eight miles. After we get the village business we go after the lighting of the stores and houses and then start to pick up the business on the farms along the line. This is quite extensive at the present time, and there are a number of farmers who do their cooking in the summer time by electricity. Mr. Parker sent us a copy of the Report of the Committee of the Eastern States and asked if some word could be sent from Dayton as to what we are doing there. As I am not as yet very familiar with the situation this paper was prepared and I have been asked to present it.

"On a farm six miles south of Dayton, to be supplied by electric current from the transmission lines radiating from the Dayton Power & Light Co.'s system, an interesting experiment will soon be made in fertilizing the soil by means of high-tension static interrupted electric current.

"The necessary equipment is now being erected and in connection therewith an elaborate system of piping is also being installed to permit of artificial rain fall, the water to be supplied by electric motor-driven pumps.

"The work is being done in a very careful, skillful and scientific manner, and will be ready for demonstration about the middle of June. Very careful data will be kept of the whole proposition, and the central stations interested in this class of business will be able to obtain information from the Dayton Company within the next 30 days. During last fall a similar experiment was tried on a small scale in a hot house on a farm near Dayton, where two boxes of radishes were experimented with. One box was grown without electrical stimulation and under normal conditions, and the other box, immediately across the aisle in the hot house, was slightly stimulated by electric current. Having the same soil, water and temperature conditions, the box containing the stimulated plants developed radishes twice as large as the ones not so stimulated.

"It was this experiment which lead to the thought of trying out on a more elaborate scale the possibility of electrical fertilization of the soil, and the work being done near Dayton will, no doubt, be watched with considerable interest by the electrical fraternity."

MR. E. P. EDWARDS, Schenectady: As one member of this Committee, or these Committees, I feel privileged to comment and criticize, particularly on one point in the Report which has been emphasized time and again. The income from farming business alone, as developed in the Central States at present, does not really justify the expense incurred in securing it.

Thirty-five years ago that statement would have been true with reference to the lighting business. You could count on the fingers of your two hands the lighting companies that paid interest on the necessary investment when the industry started, and it is still younger than a good many of us here. "Electric Farming" will not pay to-day as "Electric Lighting" did not pay, from the central-station point of view 35 years ago; but when such men as Mr. Insull and Mr. Doherty, looking into the future, see the possibilities in this line of work, I think all of us, realizing as we do, that every business enterprise is a venture, should be willing to go in with some confidence that we shall win out, as we have in the past.

Mr. Doherty has shown by a series of very interesting curves that the securities of public service corporations engaged in electric lighting are better to buy than those of any other branch of industry; they are less subject to fluctuation in panicky times. If you have not seen these curves you should get them and study them. The lighting business is on a profitable basis to-day, but it was not 35 years ago.

Electricity for the farm is not a problem of to-day; it is a problem of the future. We must take a chance, but we do not have to do it blindly. Mr. Insull pointed out last night, that in a comparatively short period this whole country will be covered with a network of transmission lines, but while this development is going on the education of the farmer is going on, and the two will get together.

The National Government has recently established a Bureau of Farm Economics, the purpose of which is to teach the farmer what it is economical and uneconomical to do. There is a bill which will be presented at the next session of Congress, to establish a Bureau of Farm Engineering, which will tend to show the farmer what he ought to do. Once he is made to realize that the cost to him of what he is doing now is not, if you please, the cost of gasoline alone, but that he must take interest and depreciation into consideration, the problem is simple, because you can demonstrate both practically and theoretically that, through the use of electricity, he can save money.

The interesting part of all this is that the rate which you may charge the farmer has relatively very little bearing on the cost of operation. In other words, once you can get him to understand interest and depreciation on his stock, or on his implements, the rate makes relatively little difference in the total cost of operation. Now we cannot sit here to-day and claim that it does not pay us to go out into the country and get orders for a load. We have got to take the chance. We must go out and build up, and in this we are being helped by the National Government. They are not only trying to do it—they are doing it. They are educating the farmer to use improved methods, and just as soon as he does that he will find that electricity is the cheapest form of power for him. When we merge our small stations in one central distributing plant, with lines reaching out in every direction, with new and cheaper methods for reducing voltage, we shall be able to take on the farmer. It may not be to-day, next year, or in the next five years, but in ten years electricity on the farm will no longer be the joke it has been these three years.

MR. M. O. DELLPLAIN, Syracuse: Around Syracuse we have found that there is a decided demand on the part of the farmer for electrical service. In connection with some extensions to reach new plants which have been developed where taxes are low, as soon as the lines were put through, in fact, before they were finished, there was a great demand from the farmers along the way for service. What they particularly wanted was lighting service.

The "back to the farm" movement, as it is called, appears to have increased this demand; people having lived in the cities and become used to city conveniences notice the absence of these conveniences on the farm, and soon apply for electric service.

The investment cost is obviously the thing that stands in the way of supplying this service. We have met with considerable success in this regard, with what we call our "contribution system." There may be a progressive farmer two or three farms away from an existing line who wants service, but the farmers in between may not. We figure out as nearly as we can, with no definite rule in mind, however, the approximate investment we could afford to make, bearing in mind future development, as well as present return, and we put this proposition up to the progressive farmer, namely, that we will extend our lines and give him service with the understanding that he will contribute a certain portion of the investment which will be returned to him should we be able, at some future time, to interest some of the other farmers along that extension. That is not a new theory as far as city extension work is concerned, but it may be a new idea as regards rural distribution.

They say that the eastern farmer is more conservative than the western, and that is perhaps true, owing to the fact that the western farmer is cultivating larger areas. We find, however, that New York State is not as conservative as it might be in connection with the use of electricity.

A feature which seems to interest and appeal to farmers as a class is the fact that we make no difference in our rates for suburban and rural service. The man on the farm can get his electricity for the same rate that he would pay if he were living in the city. That may be entirely psychological, but it is a point that we have used to advantage to arouse interest. The fact that in most of the out districts there are no gas mains creates a demand for electricity for cooking purposes, and we have two or three progressive farmers who have gone to the length of using electricity entirely for cooking during the summer.

Our chief difficulty in the beginning was in determining how we could best arrange for the service; that is whether we would step down from 11,000 to 2300, and then down to 220 volts. We have decided, in most cases, to step down directly to the lower voltage and maintain long secondary systems, longer than would seem to be economical had not your Committee brought out in its Report the fact that the long secondary distribution is probably the better solution for lighting propositions. Where power is to be furnished we have adopted the 3-phase, 220-volt system, using long secondaries also, the idea being to centralize the trouble in case of lightning disturbance, which is our principal difficulty.

There is probably no subject on which the central station will have to exercise more imagination and practise a broader policy than on this class of work. We cannot attempt to figure out what our revenue will be and decide to spend just that much. We shall have to look at this proposition in a broad way and, it is likely judging by past experience, that the broader the view we take of probable future developments in farm business, the better the ultimate results will be for us.

THE CHAIRMAN: This subject that we are talking about now is one of great interest to many of us. We have had much discussion these three years on the application of electricity to the various needs of the farm, but there is a broader point of view, that of running lines into territory where there are other kinds of industry. Quarries, railway signalling, pumping for railroad engines and other business have been well set forth in the Report. I would like to hear some discussion of the possibilities of that part of the subject, and of the type of salesmen needed to pick up that kind of business, if we can have it from someone who has had experience.

MR. L. H. SCHERCK, Schenectady: The problems of electricity on the farm and in rural districts are closely related. We have 50 miles from New York City, in the central part of the Hudson River Valley, about 75 miles of transmission lines and we operate in some 18 to 20 communities. Some of us still think of electricity for the farm in the way we once thought of line extensions. It was often a big problem to take on residential business, and I think the Proceedings of other years will show that there was much careful discussion of the advisability of going out a few blocks this way and that, to pick up detached houses.

Now, so far as connecting up with farms is concerned, it will not pay to-day, for investment costs are much too high. However, by combining farm business with the supplying of electricity to near-by villages makes another story. There are several classes of business that we can get on our lines, when you reach out and tie up with two or three communities. We find that we can get brick yards, stone crushers, and a good deal of village and town lighting. We are trying now for some highway lighting. We have not succeeded in that as yet, but I understand that in certain sections of New York State, it is soon to be tried out under appropriations from the Legislature, so that we may before long have to consider farming business simply an adjunct to other bigger things.

By extending our lines we have been able to supply small central stations with their entire output in cases where they had no water power, and with a portion of their load where they had some water power available.

I would like to mention in this connection three things that, it seems to me, deserve serious consideration. One problem is that of a cheaper method of construction, and along that line the paper of Mr. E. B. Merriam to be read before the Technical Section of the Association will be very instructive.

The next problem, especially interesting after hearing from the gentleman from Spokane, is a cheaper method of operating, something more economical than we have yet found. For instance, the recommendation to have one man read meters, collect the bills and act as a general representative on the one trip.

The third problem, still pressing and still unsettled, in spite of the great amount of consideration that has been given to it, is the question of rates. Now, it does not seem to me quite fair to the city customer to charge the country customer the same rate. I shall expect to see this bring on an agitation for a lower city rate. In the work which the Committee is doing I would like to recommend that the rate problem be not overlooked.

Without going into an elaborate discussion, I think that in all rate making we should follow, as nearly as possible, the lines of cost, and a rate which we are justified in charging for current carried out into the rural districts should be higher than that for the city. We, in our company, have adopted a plan of charging about 20 per cent more for current supplied to communities outside of congested areas.

We have taken on several kinds of farms, fruit farms, dairy farms and others, simply as an advertising proposition. We have extended our lines, assisted the customers in fixing up and putting in all the different kinds of electrical devices and, forgetting about profit, rate and cost for the present, have simply treated them as a form of advertising.

I am sorry that our experiments have not been in existence long enough to give you some results, and we have yet to work out what we think is an equitable rate, but it seems to me if the rate be equitable it must be based on a fair service charge and a low energy charge. All we have been able to find out so far, is that the kilowatt-hour consumption will be very small indeed, except possibly, where there will be considerable irrigation.

MR. BASS, East St. Louis, Ill.: We operate through St. Louis and Franklin Counties, the latter lying directly west of and adjacent to St. Louis. I would like to hear some discussion on the method of charging for the extension of lines into different communities.

Mr. Kennedy: I do not know that the methods adopted in my part of the country would apply, but on general principles we have used the plan of making extensions free of charge where the income the first year will be equivalent to 50 per cent of the line cost. As the rural business increases and population becomes more dense we are inclined to reduce that percentage. In other words, we are finding that the rural business is developing more rapidly than was at first anticipated, and, getting under the 50 per cent, are inclined to make extensions on the basis of 40 per cent; that is, where the first year's income is equal to 40 per cent of the cost of extending the line to supply any particular customer or group of customers.

Mr. R. S. Wallace, Peoria, Ill.: We have adopted a method of arranging for extensions on the basis of the farmer paying $25 on the cost, to come in, so to speak, we to furnish all of the poles and cross-arms ready for the pins; and we get his permission in every instance to go beyond his place in case we work up other customers for service.

Another thing we have had a little experience with is the high cost of construction in proportion to income. I have figured out a little analysis of some of the extensions we have made, and I find that so far we are operating at a slight loss. The loss is so little, however, that I am really optimistic as to the future prospects of the farm business. In what lines we have put up so far, we have been very careful to keep the first cost as low as we dared. In some cases we used a No. 9 iron wire on otherwise standard construction and all things considered—interest, depreciation, cost of construction, etc.—our revenue has been just a little below the cost for each individual extension. Some of our lines have two, three, five, and as high as eleven customers, and our average income from these has been a little over $27 a year.

As has been pointed out, these farm installations seem to assume local color; they are all different. The farmers are beginning to put in a motor here and a motor there. They will get a one or two horse power motor, belt it to a line shaft, and arrange it to do nearly all the work they have to do around the farm, their washing and pumping, the cream separating, and everything that can possibly be done with one motor. The indications are that in the future it is going to be better business.

Mr. F. V. Underwood, Birmingham, Ala.: I would like to say that in making line extensions in the Birmingham district there is a yearly income of possibly 20 to 30 per cent of the total line cost. We are doing this mostly on five and seven-year contracts and we have a list of coal mines and iron mines.

The Chairman: I will ask Mr. PenDell to close the discussion, if he will, and perhaps he can say something about the line extensions that we have in Northern Illinois.

Mr. PenDell: The subject of line extensions seems to be the one in which there is most interest. There are three general schemes in vogue covering the extension of lines in the out districts:

1 In some communities customers make their own line extensions; it may be a single customer building a line to his own property, or it may be a proposition where several farmers go in together and put up a community line, owning and maintaining the line themselves. There is some question as to the advisability of encouraging these privately owned lines, since the central-station company does not have full control of the lines and the maintenance, and they may, perhaps, not be kept on a par with the other lines of the company.

2 In some cases the customer is required to deposit with the company the cost of the extension and the money deposited is credited to the account every other month to the amount of the bill for current rendered to the customer for said month, thus rebating the cost of the line to the customer.

3 The most general scheme is for the company to extend its lines to customers on a guaranteed income of such amount that the cost of the line will be returned to the company in from one to three years; some companies requiring that the income shall be equivalent to the cost of the line in one year and others in three years. The guarantees vary from time to time, according to the condition of the money market when the extension is made. Five-year contracts seem to be rather common for all line extensions of this nature.

In Northern Illinois there are a number of industries which we have covered in our Report, other than purely farm business. One industry within 40 miles of Chicago is the sand and gravel business. One gravel pit will give an income of from $150 to $500 a month. An income of $300 per month on a line extension of three miles, with a five-year contract, is good business.

Stone quarries are another big source of revenue in our territory. We have numerous plants with connected loads of from 100 to 350 hp., while the largest one we have has a connected load of something over 3000 hp.

The clay-making industry, or the tile and brick-making business, is one that can be picked up everywhere if they have the right kind of plant. From the central-station salesman's point of view there are two classes of brick-making plants, one class using steam for drying their product before burning, and the other using waste heat gases.

With a brick-making plant that uses steam drying it is a pretty hard problem for the central station to get the load, because it requires far more boiler capacity to dry the brick than for making power during the day. Where they use waste heat gases for their dryer, the central station has a good chance of getting the business at a very good rate. We do not have to go down to a cent and a half for this class of brick making out in the country. We can get it at two and two and a quarter cents very easily.

Railway signaling is something with which California and Massachusetts have had some experience. Alternating-current signals on a steam road will require from one-quarter to one-half of a kilowatt per mile. The load-factor of the business will be somewhere between 95 and 100 per cent. It is an absolutely steady load and the only time there is any fluctuation of more than 10 per cent in the load is when the circuit trips out and is picked up again. Picking up all the load will take about twice as much power as the average demand and will last about 15 seconds.

Railway pumping plants are a good source of revenue for the central station. All along the railroad rights-of-way we find small pumping plants. The tanks are there and the pumping plants have to be placed somewhere. By installing automatic control of the pumps you can eliminate the pump men at these plants. Cutting out the pump man is cutting down the biggest part of the expense of the pumping plant, and railroads all over our section of the country are becoming very much interested in automatically controlled pumping plants for water service at different points.

THE CHAIRMAN: The next number on the program is the Report of Mr. R. S. Hale, of Boston, Chairman of the Committee on Wiring of Existing Buildings.

REPORT OF COMMITTEE ON WIRING EXISTING BUILDINGS

The process of getting existing buildings wired may be divided roughly into the following:

First. Advertising, soliciting, and the general problem of getting the prospective customer interested.

Second. Finding out what quality of work the customer desires and can afford to pay for and locating the lamps in his rooms for convenient use.

Third. The illuminating engineering problem.

Fourth. The general engineering problem, methods of wiring, quality of insulation, etc.

Fifth. Closing the contract, doing the work, and collecting the money.

These problems are to be taken care of by the customer and the wiring contractor, assisted by the central station, and the province of your Committee is to point out how these parties can best work together.

The division of work as to some of the items is very clear. For instance, the question of the quality of wire or insulation should be determined by the central station or the wiring contractor, and not by the customer; while, on the other hand, such questions as the location of switches, or even of outlets, is primarily a matter for the customer to decide with, perhaps, the assistance of the others. Such questions as who shall put in the meter board and whether a ground wire will be required, are for the central station to decide. Other items are handled sometimes by one sometimes by the other of the parties interested.

Experience in several cities has shown that having the advertising, soliciting, letting of contracts and the wiring itself, follow along definite, prearranged lines leads to more business than handling each prospect by a different method, when there is no real difference in the conditions.

The first problem is that of creating a desire on the part of the customer, and the Committee believes that the greater part of this work should be undertaken by the central station, for the reason that most of the advertising and soliciting should be directed towards promoting the use of electricity in general, rather than the employment of a particular wiring contractor. Such soliciting as is done by the contractor naturally has in view his own employment, and will not accomplish the desired end as efficiently as work done by the central station.

While the advertising and solicitation of business from existing buildings may be slightly different from that done for new buildings, both come under the province of your Advertising Committee, the Committee on Wiring Existing Buildings taking up the problem when the customer thinks he might like to wire his house.

When this point has been reached the customer immediately wants to know what he is going to get and what he must pay. Before anyone can tell him there are certain questions which the customer only can answer, and in order to make the answering easier the Committee has prepared an Information Sheet on which these questions are shown in quite complete form.

INFORMATION SHEET

Address
Class of house (local rules would define the classification)
Number of stories
Is house detached, or part of a block or double house?
About how far back is the front wall from the sidewalk line?
Is the house of wood, brick, stone or cement?
If part of the house is of one construction and part of another, note this, giving details
If of brick, stone or cement, are the entire walls the same, or are the inner walls frame (studding lathed over)?
Is there an air shaft or back stairs?
If the building is not to be wired throughout note the rooms omitted and their location

NOTE—The prices to be quoted assume, unless otherwise specified, that there is no deadening material between floors, and no brick or cement partition in any wooden house.

This form can be cut down if any central station or contractor finds a shorter one that will serve better; and, in fact, all the suggestions of the Committee will be given quite fully with the

	Porch	Front hall	Reception room	"	"
1 Ceiling outlet for fixtures.					
2 Number of lamps.					
3 Ceiling outlet with drop cord and key socket.					
4 Ceiling outlet with drop cord and chain socket.					
5 Wall outlet for fixtures.					
6 Number of lamps.					
7 Wall outlet with flush receptacle.					
8 Wall outlet with moulding receptacle.					
9 Baseboard outlet with flush receptacle.					
10 Floor outlet with flush receptacle.					
11 Floor outlet with water-proof receptacle.					
12 Wall outlet with special heating receptacle.					
13 Baseboard outlet with special heating receptacle.					
14 Floor outlet with special heating receptacle.					
15 Outlet with single-pole switch.					
16 Outlet with double-pole switch.					
17 Outlet with 3-way switch.					
18 Outlet with 4-way switch.					
19 Outlet with 2-point electrolier switch.					
20 Outlet with 3-point electrolier switch.					
21 Automatic door switch.					
22 Outlet for bell ringing transformer.					
23 Ceiling switch outlet.					
24 Two switches or receptacles come out at the same point or in gangs.					
25 Three switches or receptacles come out at the same point or in gangs.					
26 Four switches or receptacles come out at the same point or in gangs.					
27 Hardwood or parquette floors in room above.					
28 Bathroom or closet above this room.					
29 Number of wall outlets on brick wall that is not furred.					
30 Wiring must be concealed—armored cable must be used.					
31 Wiring must be concealed—in flexible metallic conduit.					
32 Wiring must be concealed–knob and tube work.					
33 Wires must be in metallic moulding.					
34 Wires may be in wooden moulding.					
35 Wiring may be open on porcelain insulators.					

idea that if there is to be any change made it will be easier to condense than to elaborate. We may also note at this point that while the title of our Committee, viz., "Existing Buildings," includes business places as well, the Committee will confine itself this year to residences and apartments only.

On this Information Sheet, then, we have attempted to give all the questions that the customer can and should answer, and no others. Questions that can be solved by the contractor or the central station representative only are not on the sheet because the customer should not be bothered with them. If they are to be answered at all, one of these two parties will have to inspect the house; but experience indicates that (especially for small and medium jobs) the information that is covered by the sheet gives *all* that is necessary for making a price. Of course the solicitor or the contractor usually helps the prospect to fill out the sheet.

The next question is as to what work should be done by the contractor and what by the central station. For any given city this has been pretty well settled, but conditions vary in different cities, in one the company supplying the meter board, in another requiring the contractor to do it, etc. While local conditions may differ, we believe that the many differences now existing are due chiefly to accident, and that some companies could improve their practise, either by including certain items free of charge, or giving them over to the contractors as part of the wiring work. We give a list of these various items and some notes as to the practise in a few cities.

Cost of Wires from Mains to Lot Lines

When an extension of line requires a large investment, special deals as to guarantees of income are often made, but these are really questions separate from the present one. Except when these guarantees come in, any installation in public streets is almost invariably paid for and owned by the central station. There is one exception to this, as follows:

If a customer in an overhead district wants an underground service, there are companies which will charge him the cost of such an underground service less the amount he would have had to pay for an overhead service. In these cases it appears to be general practise to consider the cost of the underground service as including the pipe down the side of the pole.

Any question as to the ownership of these wires in the public streets that have been in part paid for by the customer, has apparently not yet come up.

Cost of Wires from Lot Line to Building—Overhead

It appears to be universal practise to supply one stretch of wire free of charge, the ownership of this wire remaining with the central station.

If poles are required for the convenience of the central station the custom appears to be to make no charge for these, even if placed on private property, except in special cases.

When poles are required for the customer's convenience, as for instance, when a house sets back a long distance from the street, it appears to be almost universal practise to require the customer to pay for these and for the additional stretches of wire required.

Cost of Wires from Lot Line to Building—Underground

The practise in regard to this varies as follows:

In one city no charge is made for two feet or less; a charge is made for all additional lengths. In another city no charge is made for 10 feet or less, but a charge is made for all additional lengths. In still another city no charge at all is made in the downtown district, irrespective of the distance, while in the uptown districts a charge is made for the full distance. This is probably due to the fact that in the downtown district the set-backs seldom exceed ten feet.

In most other cities a charge is made in every case for the entire distance.

Service Switch and Cutout

In about half our cities this appliance is supplied by the central station, and in the other half by the contractor.

Meter Board

The meter board is supplied by the wiring contractor in most cities.

Ground Wire

The ground wire, if required at all, is supplied by the wiring contractor in most cities.

GENERAL AVERAGE

If practice ever becomes uniform throughout the country it would appear that it will be along the following lines, which seem to represent the general average.

Cost from main to lot line to be borne by the central station in all cases.

For service from lot line to building: If overhead, the central station to supply one stretch of wire free and to make a charge for any poles and additional wire required; if underground, the central station to supply a few feet of wire free, and to make a charge for all additional lengths. The Committee suggests two feet.

Service pipe down the side of the house (for overhead service) to be supplied by the wiring contractor.

Ground wire to be supplied by the wiring contractor, if needed at all.

Service switch and cut out—impossible to predict (practice as to this is at present divided).

Meter board to be supplied by the wiring contractor.

The local rules as to what will be done by the central station and what by the contractor are made by the central station, and, together with the Information Sheet, as filled out by the customer, show what work is to be done, though by no means how it is to be done or what it will cost.

If it be a case of an expensive house, the question of how the work is done is more important than the cost. As one contractor expressed it, "If I do a job in Beacon Street, I know they will want my man to wear moccasins and to sweep up every chip before he makes a new one, and they don't care what it costs."

Such cases, after the customer has got a very general idea of the amount he will have to pay, can best be handled on a time and material basis, and the central station can probably accomplish the best results by getting the customer and contractor together and leaving them alone. Further, it should be noted that in such cases it is of no particular advantage to bring in any competition between contractors, although, of course, if the customer wishes, the central-station solicitor will give him the names of more than one from whom he can get the kind of work he wants.

In the case of medium-sized and small houses cost is of very great importance, and in these small jobs the time spent in figuring the job and laying out the work becomes a large per cent of the total cost, so that any reduction in this part of the work is likely to mean a distinct saving, since, it must be remembered the cost of figuring for competitive work which is lost must be included in general expense.

Now the actual cost of wiring depends upon various items; first, on the number of lamps and governing conditions. For instance, if 12 lamps per circuit are allowed, the cost per lamp will usually be at a minimum for 12, 24, or 36, and will be higher for any intermediate number; but this cannot be determined beforehand, because the location of the outlets might be such that for 36 four circuits would be required, instead of three, etc. It is, however, the opinion of the Committee that units can be selected and specifications drawn so that for any particular class of house a contractor may quote unit prices without regard to the exact number of lamps and yet be reasonably sure that his average will come out about right. This has been our experience in several cities, and has resulted in a very distinct saving in the cost of soliciting and bidding for work. The saving usually divides itself among the three parties; the customer getting his wiring at a little less than if each job were figured separately; the contractor getting the average per cent of profit on his work, but more work, and the central station getting more business.

The work of your Committee was carried on as follows:

At the first meeting a general discussion resulted in laying out the work along the lines of this report. Between the first and second meetings the members and reporters submitted figures for costs, divided into labor and material. At the second meeting these estimates were discussed, the reasons for differences discovered when possible, and finally a sort of general average was struck. It may be noted here that all who submitted estimates were requested to adjust labor figures to $4.00 a day for wiremen and $2.00 a day for helpers.

To figures of this sort something must be added for so-called general expense. This is a difficult item to allow for, especially in the case of central stations that do wiring in connection with other business. While your Committee believes that, as a general principle, central stations should keep out of the wiring business, it recognizes that there are special circumstances which justify them in doing this business, as, for instance, when there are no electrical contractors available; and, also, that there may be situations which would warrant their doing wiring business in competition with the contractors. Your Committee believes, however, very strongly that when the central station goes into the wiring business it should include in its estimates of cost practically the same sum for overhead charges that would be included by an electrical contractor doing a corresponding amount of business, since the station, no matter how it enters the charges on its books, cannot eliminate these expenses.

Your Committee had before it the data collected by the National Electrical Contractors' Association in reference to general expense, which seem to be the only authentic data that have been collected on this subject. These data were collected by the Contractors' Association from its members located in practically all sections of the country, and doing varying amounts of business, running from $10,000 to over $100,000 a year. The Association, in collecting these data, divided them into classes in accordance with the amount of business done, but, in addition to this, an average was struck from all reports received, regardless of the amount of business or the location. The data seem to cover thoroughly the subject of general expense, including among others such items as salary, rent, light, heat and power, telephone and telegraph, office help, insurance, advertising, overseeing, freight, cartage and expressage, printing and postage.

These data showed the Committee that the average expense of conducting a contracting business is 22.2 per cent of the amount received from the gross sale of the business. This would mean that in estimating work 28.6 per cent should be added to the cost of labor and materials to cover the items of general expense, but, for convenience in figuring, the Committee used 30 per cent as a basis for arriving at the overhead charge. The Committee wishes to make clear that this is an addition to cover simply the expense of conducting a business for the installation of wiring, and that the 30 per cent does not include any profit on the work. The figures given by the Committee, therefore, in the following portions of the report, are intended to cover the cost of labor and cost of material, plus 30 per cent for general expense.

The Committee recognizes that any figures it submits will suit, at best, only a single set of conditions; nevertheless, it believes that some definite figures will be of value, if only for the purpose of discussion. *In fact it believes that the chief value of its figures will be in starting discussion and leading to the statement of more correct figures.*

As the question of the proper amount of profit is one very difficult to determine, the Committee recommends that price-lists should be made so high that ordinarily a large discount may be given. In its final price-list, given on page 318, the costs have been doubled and from these discounts may be given according to the special conditions in each case.

DETAILS OF WORK AND UNITS

The first piece of work is to carry wires from the company's existing mains to the customer's property. This work is almost invariably done by the central station and remains its property so that it need not be considered further.

The next work is to carry the wires from the lot line to the building. If the service is overhead the central station usually does this free of charge, unless it is necessary to set poles. If a house stands back some hundreds of feet the central station will usually have to make an extra charge of so much a pole, including the pole itself, the setting, the cross-arms, etc., and the second stretch of wire. The following figures were taken as fairly close:

Pole, cross-arms and pins and copper wire	$12.00
Labor	8.00
	$20.00

Adding general expense, a figure of $25.00 or $26.00 per pole would be about right, with, of course, extra provision if special poles were called for or blasting required. In most cases, however, if a pole is to be set the central station engineers will have to make a special inspection, and can quote a more accurate price without waste of time.

For underground work the free distance varies with different companies, but all would charge for very long set-backs.

Cost of Underground Service per Foot

The cost of labor for a trench about two feet deep in earth was given by various contractors in figures running from 20 cents to 25 cents per foot. There were two figures above 25 and one figure below 20 cents. The cost of material for three No. 6 wires and a fiber pipe laid in cement was given as from 44 cents to 61 cents. There were two figures above 61 cents.

After a study of these figures the Committee suggests a cost of $1.10 per foot, including general expense.

Attic Entrance from Overhead Service

The old-fashioned attic entrance is, in the opinion of the Committee, not economical, except in special cases or for temporary work, and will not be considered.

Service Pipe Down the Side of the Building from Overhead Service

The basis of this was taken as two No. 8 wires and a ¾-in. galvanized pipe, the wires to be rubber covered.

The cases where a larger size of wire or three wires or a larger pipe would be required, are all cases where there are to be fairly many lamps, and may, for the sake of simplicity, be taken care of by a surcharge of a few cents per lamp, so that the price for the service entrance could be made the same for any number of lamps from 1 to 100. Then, when the number of outlets is to be so large as to require more wire or larger pipe, the extra cents per lamp on the total number will be enough to take care of the extra cost of the larger pipe and third wire.

The estimates on the cost of labor for such an installation ran from $1.30 to $3.30. The higher figures were from reporters and members not present at the meeting, who had undoubtedly figured on three wires, and the general average was finally taken at a labor cost of from $1.50 to $2.00.

The estimates of the cost of material ran from $1.60 to $5.15. After a general discussion on a basis of 20 feet of pipe, 50 feet of rubber-covered, double-braided, solid wire, 2 condulets, clips and bolts, an average was finally taken on the total cost of material at $3.00. Then, after adding the allowance for general expense, the result would work out to a cost of about $6.18, or $6.00, in round numbers. The estimates for longer lengths than 20 feet of pipe resulted in figures giving a cost of 30 cents per foot for anything above 20 feet.

Cost of Ground Wire

This cost appeared to depend greatly on the run and on the size of wire required by different authorities, varying from No. 10 to No. 4. Some companies apparently get along with very short runs, not grounding to the water pipes but directly in the earth.

The final general opinion was that the cost would run about 10 cents per foot for labor and a like amount for material, and the average run would be about 15 feet. This would indicate a net cost of 26 cents per foot, including general expense, and for a 15-foot run about $3.90, or $4.00 in round numbers.

If we considered the case of an attic entrance, the ground wire would cost more.

The Committee suggests that the present variation in size of ground wire from No. 4 to No. 10, cannot be due to difference in local conditions, and that reports be asked for in cases where No. 10 has not proved satisfactory and No. 4 would have been safe.

Cost of Installing Service Switch if Not Done by the Company

The labor cost was estimated at from 50 cents to $1.00, and the material cost, from $1.15 to $2.00, except where a special grade of switch was required by the central station. These would indicate a net cost of approximately $2.25, including the allowance for general expense.

Cost of Run from Service Entrance to Center of Distribution

Conditions in different cities seem to vary greatly according to whether the center of distribution is placed in the basement or in the upper stories. The general opinion was that exposed metallic conduit should, properly, be used in the basement itself, and that from the basement up to the center of distribution, in case the latter was above, flexible metallic conduit or armored cable should be used.

The labor costs, on the basis of running 40 feet, were given by various estimators at from $1.26 to $7.50, the highest figure being from a city where the center of distribution is almost invariably in the second story. The general conclusion reached was to fix a labor cost of $2.75.

The estimates for material costs were, in this case, quite uniform, the lowest being $5.00 and the highest $7.50. The figure finally settled upon was $6.00.

These figures, after adding for general expense, indicate a net cost of approximately $11.33, or $11.50 in round numbers.

It should be noted that this cost would be very much less in small houses, and a cheap or inexpensive workingman's cottage, for instance, would probably not require this run at all.

Meter Board

The cost of the meter board was estimated at from 10 cents to $1.00 for labor and from 25 cents to $1.50 for material. The figures finally came down to 20 cents for labor and 25 cents for material, which, after adding the general expense, would indicate a net cost of about 55 cents, or 50 cents in round numbers.

Taking now the various service charges, we find them as follows:

Service pipe	$6.00
Service switch	2.25
Ground wire	4.00
Meter board	.50
Run to center of distribution	11.50
	$24.25

These are the various expenses that are necessary, independent of the number of lamps. In the case of a very few lamps, however, the run from the center of the building disappears, and for an average building of 10, 15, or 20 lamps the cost would be less, but per contra, these small jobs are apt to have a higher percentage of general expense. Suppose we take $15.00 as covering, for a small job, the various fixed costs noted above.

If now, instead of the number of lamps that can be taken care of by two No. 8 wires in the pipe down the side of the building, and with no run from the service entrance to a center of distribution, we have a number of lamps so large that a 3-wire service is required, there will be an extra cost for perhaps 25 feet of wire in the service pipe, and the pipe down the side of the building may have to be larger, etc., etc.; and whenever the number of lamps is large, there is, also, apt to be a run from the service entrance to the center of distribution, which increases this fixed cost of $15.00 to a total of about $30.00.

Suppose we allow roughly that these extra costs would be about $15.00 for a 60-lamp, as compared with a 10-lamp job; this, divided by the difference between 10 and 60 lamps, is 30 cents per lamp, hence, if we add this 30 cents in all cases we get $3.00 extra on the 10-lamp job, and $18.00 extra altogether for the third wire, and the run to center of distribution, on a 60-lamp job, which works out about right.

In cities where the service switch is supplied by the central station these figures might be reduced accordingly. In other cities there may be special costs not included in those mentioned. Such variations are to be expected.

Next we come to the circuits themselves, and in figuring the costs of the various kinds of outlets and of wiring, the Committee decided that the simpler method would be to first consider a standard ceiling outlet to consist of the proportion of the cutout box and the fuse, the cost of the loop to the outlet, the outlet box in case of concealed work, or the rosette in case of open work, the total making the cost per outlet, which would be the same whether used for a switch or for lamps. We would then give the costs for the various kinds of wiring.

Next, in considering the other outlets, as, for instance, wall outlets, floor outlets, etc., we would figure the percentage difference between such outlets and the standard outlet, on the basis that the percentage difference would be about the same whatever the kind of wiring.

Open Wiring

For open wiring not many members or reporters sent in any estimates. Such as we had were quite uniform, indicating, for a standard ceiling outlet, a labor cost of 60 cents and a material cost of 75 cents per outlet, or, adding for general expense, a net cost of $1.75 per outlet.

Standard Ceiling Outlet with Wooden Moulding

For a standard ceiling outlet with wooden moulding, the estimates on labor ran from 55 cents to $1.50, the figure finally assumed being in the neighborhood of 75 cents. The material costs ran from 63 cents to $1.50, the final being in the neighborhood of 85 cents, indicating a net cost of $2.60, including general expense.

Standard Ceiling Outlet with Concealed Knob and Tube Work

For a standard ceiling outlet with concealed knob and tube work, involving the use of some flexible, non-metallic conduit, the estimates for labor ran from $1.15 to $2.00, and the general opinion finally settled upon an estimate of $1.50. The figures for material ran from $1.26 to $1.75, the final estimate being $1.50, which, after including general expense, indicated a net cost of $3.90.

Metallic Moulding

For metallic moulding the estimates for labor ran from $1.25 to $1.90, coming out finally at $1.50. The estimates for material ran from $1.04 to $2.00, the final figure being $1.75, which, after adding for general expense, indicated a net cost of about $4.23.

Armored Cable

For armored cable the estimates for labor ran from $1.00 to $2.50, and for material, from $1.25 to $3.50. The low figures were from a large company which had peculiar facilities for buying material very cheaply, and which was doing a great deal of work in houses where the runs were short. The high figure was for material bought under certain other special conditions. The general opinion finally settled to a cost of $1.75 for labor and $2.00 for material, or, after adding for general expense, about $4.87 as net cost.

As in the case of hardwood floors noted below, the discussion seemed to indicate the possibility that with considerable experience and a large amount of work, the cost of this kind of wiring might be brought well under these figures. This, however, is a possibility only, and has by no means been proved.

Flexible Metallic Conduit

The estimates for labor ran from 75 cents to $2.80, the general consensus of opinion finally reaching $2.00. The estimates for material were from $1.25 to $3.50, the latter being due to some special conditions. A cost of about $2.00 was finally agreed upon, which, after adding for general expense, indicated a net price of about $5.20.

Following is given a summary of the foregoing figures. These figures do not include any surcharge to cover the cost of a third wire service, etc., in large jobs.

Standard Ceiling Outlet	Labor Cost	Material Cost	Total including 30 per cent for General Expense
Open wiring	$0.60	$0.75	$1.75
Wooden moulding	.75	.85	2.60
Concealed knob and tube work, some loom	1.50	1.50	3.90
Metallic moulding	1.50	1.75	4.23
Armored cable	1.75	2.00	4.87
Flexible metallic conduit	2.00	2.00	5.20

Wall Outlets

Estimates as to the comparative cost of wall and ceiling outlets developed some interesting results the following figures showing the difference of opinion as to the percentage to be added to or subtracted from the cost of wiring to a ceiling outlet to get the cost of wiring to a wall outlet: + 30 — 15 + 12 + 8 + or — 25 + 5 + 5 + or — 10.

These differences are of course due to the comparative number of times when the wall outlet can be taken in the run up the side of a building at low cost, instead of requiring a separate loop at higher cost. The general opinion seemed to be that on an average a wall outlet would cost about 5 per cent more than a ceiling outlet.

On the ground, however, that the proportion of wall to ceiling outlets should be fairly near uniform, it would seem safe to make the price for wall outlets the same as for ceiling outlets, since this will result in a much simpler figure. Of course if it is found that in a given class of house the wall outlets are cheaper or more expensive, as the case may be, than the ordinary ceiling outlet, prices should be charged accordingly.

Baseboard Outlets

In the same manner, the estimates on the cost of a baseboard outlet were sometimes more and sometimes less than that of a ceiling outlet. The general opinion seemed to be that it cost slightly more, but for the reason that it seemed wise to recommend the same price for a wall and a ceiling outlet, it would seem wise to make the same price for a baseboard outlet.

One member had local conditions that made his costs for baseboard outlets much higher, and of course these must always be considered.

Floor Outlets

Some estimates were more and some less in cost than those for ceiling outlets. On considering the matter further, however, it would seem that a floor outlet should cost about the same as a ceiling outlet, since the runs would be the same and the only difference would be whether a hole were made up into a floor, or down into a ceiling, the extra cost of opening the floor being balanced by the difficulty of working overhead on a ceiling outlet.

This question naturally brought out the opinion that probably there is a very distinct difference in cost as between houses that have several stories and houses with only one, a given outlet probably costing more in a room upstairs than in a room downstairs. The general feeling of the Committee, however, was that it is not advisable to take this into account on any price-list, even if it could be determined.

This matter is also referred to later on when it is suggested that an extra charge, or rather an extra item be added to the estimate for each room of the house.

Switch Outlets, Single Pole

A switch outlet would almost invariably be a wall outlet. The various estimates, as in the case of a wall outlet, came out at a trifle more than for a ceiling outlet. As for a wall outlet the Committee suggests figuring the wiring cost as the same. This, of course, is for the wiring alone, the switch itself being extra.

For a Double Pole Switch

The estimates all ran that the cost would be considerably more than for a single pole switch, on account of the extra wiring, and the final consensus was that the cost should be about 30 per cent more, or 130 per cent of the cost of wiring for a standard ceiling outlet.

Cost of Ceiling Switches

This item was suggested by one or two members of the Committee as particularly applicable when ceiling outlets were put in with moulding, the switch being placed in the ceiling close to the door, so that it would be pulled from the door, instead of from the center of the room. Such a switch would obviously be very desirable for this class of work, and would cost much less for wiring than a wall switch. Having in view that in many cases the wireman could arrange the runs so that such a switch would not require any extra wiring at all, the general consensus was that such a switch (wiring only) could be figured on an average at 30 per cent of the cost of wiring a standard ceiling outlet.

Three-Way Switches

For a pair of 3-way switches the figures ran from 300 per cent to 360 per cent of what one standard ceiling outlet would cost, the general opinion favoring 320 per cent.

When a 4-way switch is needed in addition to a pair of 3-way switches, the opinion was that 50 per cent should be added to the cost of the pair for each 4-way switch furnished.

As in other cases, it should be pointed out that, depending on the location, the 4-way switch may cost more or less than one-half of the pair of 3-way switches. If the additional point came between the first two, the extra cost would be slight; if at a distance, considerably greater.

Electrolier Switches

A 2-point electrolier switch was considered to cost about the same as a double-pole switch, or 130 per cent of the standard ceiling outlet. A 3-point electrolier switch was considered to cost about 25 per cent more than a 2-point, making it about 160 per cent of the standard ceiling outlet.

Special Heating Device Outlets

The cost of the special circuit for a heating device outlet with No. 12 wire was estimated at from 145 per cent to 220 per cent of what a single outlet on an ordinary circuit would cost, and the final consensus was that such an outlet and separate circuit would cost about twice what the standard ceiling outlet would cost.

Automatic Door Switch Outlets

For an automatic door switch outlet, the general opinion was that the cost of wiring would be about 130 per cent of the cost of a ceiling outlet.

Extra Charge for Cutting Hardwood Floors

The discussion of an extra charge for cutting hardwood floors resulted in an interesting discovery. The figures from one set of reporters and members varied from $2.25 to $3.00, averaging about $2.50; those from another set ran in the neighborhood of from 50 cents to $1.00.

The fact was finally brought out that the high costs named were for cases where the contractor did not do the cutting, and a carpenter was sent for, or an inexpert man had to do it slowly and carefully. The low costs obtained were from reporters and members who had to do with gangs of men trained to cut hardwood floors as well as to do the wiring. One of these contractors was paying the men who were skilled in cutting hardwood 25 cents a day more than his ordinary men, but he figured the extra charge in case of hardwood at a very low amount.

As the average wiring contractor would not have enough work of this sort to ensure his getting these low costs the consensus of opinion was in favor of a charge of about $2.50 for labor, or, including general expense, about $3.25. Contractors who can get enough of this work to do to bring their costs down should be able to quote a low price on jobs containing much cutting of hardwood.

The question of double floors was considered, but the Committee recommends that they be omitted from price-lists on the ground that while the customer can always tell whether they are hardwood or parquet he will seldom know whether they are double or not.

To cover the extra charge where an outlet is called for on a brick wall, not furred, involving channeling, etc., the estimates varied from 75 cents to $6.00. As there would not be many of these items, the Committee finally suggested a net cost of $2.50, which, after adding for general expense, would make a total of $3.20.

For a credit to be allowed where two or more switch outlets or a receptacle and a switch come out at the same point the general agreement was for an allowance of 65 cents for cost, including general expense.

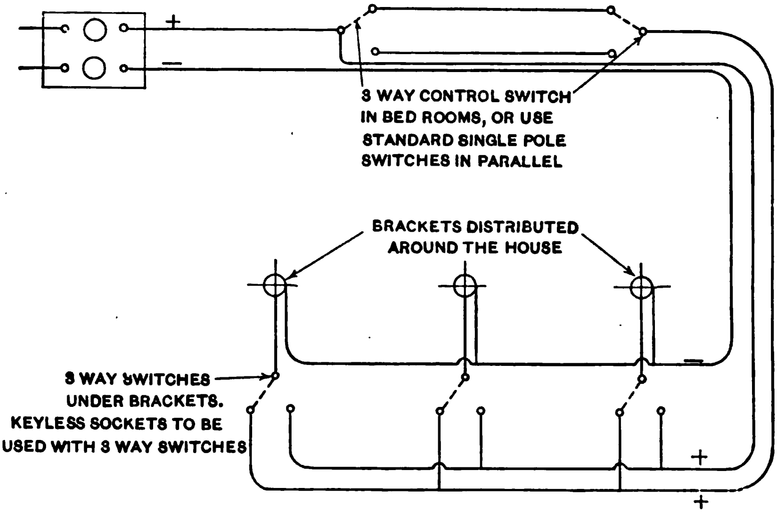
In a case where two wall outlets come back to back an allowance of $1.00 was finally agreed upon, but the Committee was of the opinion that it would not be wise to complicate the presentation of the matter to the customer by making any allowances, taking care of these in the general run of averages.

In regard to the labor cost of installing the various switches, receptacles, etc., the estimates ran from 15 to 40 cents, the final figure being approximately 25 cents, including general expense. The door switch and the bell-ringing transformer costs were estimated to come to considerably more than this.

In regard to emergency systems, which have been installed for the most part in Chicago, the following is a description and estimated cost:

EMERGENCY LAMPS FOR RESIDENCES

In the wiring up of residences it is very desirable to install a number of emergency lamps, distributing them around the house and controlling them by a switch or switches in the bedrooms, so that general illumination throughout the entire house may be had at a moment's notice in urgent cases. Heretofore the chief objection to this plan has been that these special lamps were not available for any but emergency purposes. This is objectionable, as it looks bad to have certain lamps in a room which cannot be used for general illumination. This defect may be overcome by installing the wiring as shown on the diagram given below.


+
−
3 WAY CONTROL SWITCH IN BED ROOMS, OR USE STANDARD SINGLE POLE SWITCHES IN PARALLEL
BRACKETS DISTRIBUTED AROUND THE HOUSE
3 WAY SWITCHES UNDER BRACKETS. KEYLESS SOCKETS TO BE USED WITH 3 WAY SWITCHES
−
+
+

EMERGENCY WIRING

The idea is that emergency lamps have three wires run to them, the first wire being a common negative, the second wire being positive and connected up to the emergency switch or switches in the bedrooms, and the third wire also positive, but shunting around the emergency switches in the bedrooms. Each emergency lamp is provided with a 3-way switch which acts as a throw-over switch, so that in order to use the emergency lamp for general illumination, current is supplied to it by means of the common neutral and the third positive wire, which is shunted around the emergency switch as described. It is obvious that when an individual emergency lamp is turned off by means of the 3-point switch directly under it, it is thrown on to the emergency circuit so that it can be controlled from the emergency switches in the bedrooms.

If an emergency system is decided upon it is well to include as many important outlets as possible, providing the number of lamps does not exceed the number allowed on one circuit.

Assuming that the lower and upper hall lamps are controlled by four 3-way switches but are not connected to the emergency system, an example of a very convenient method follows, *i. e.:*

In the owner's bedroom at the head of the bed install a 3-gang box containing one master switch for emergency system, one single-pole switch for ceiling outlet in bedroom and one 3-way switch for second floor hall lamp. The master switch will control the following ceiling outlets, which, in turn, would be operated by their respective 3-way switches.

Living room	one	3-lamp	ceiling	outlet.
Library	"	2-lamp	"	"
Dining room	"	4-lamp	"	"
Butler's pantry	"	1-lamp	"	"
Kitchen	"	1-lamp	"	"
Basement	"	1-lamp	"	"

This will enable the occupant who is suddenly awakened at night to turn on these 12 lamps by means of the master switch, as well as his bedroom lamp and the second floor hall lamp.

On the wall near the upper hall lamp another 3-way switch should be placed to operate the first floor hall lamp.

The average price for emergency systems, not including, of course, the 3-way switches for halls, is $40.00, on the basis of concealed armored cable.

Pilot Lights

A pilot light on a cellar or heating circuit should, if installed in a place designated by the customer, cost the same as the standard outlet. If, however, the wiring contractor is allowed to install such a lamp at a point suited to his plans, the cost should be taken as 30 per cent of that of the ordinary ceiling outlet.

Door Lamps

The cost of running wires from a bell-ringing transformer to a door lamp was estimated at $2.00, which becomes $2.60, including general expense.

We are now ready to compile an elaborate cost list, and in this report we give both the costs as indicated in what has preceded and a list price of double these costs. These, however, are given for the wiring alone. No figures are given to cover the cost of the fittings, such as switches, drop cords, etc., as it is expected that solicitors and contractors using the list will already have these prices.

Any list to be shown to a customer would have to give the switch prices also, but would usually be much simpler than the following. When contractors or central stations are simplifying the list they should add the switch prices, either net or list, subject to a discount.

		Cost	List
1	Each pole and stretch of wire (special prices if blasting is required)	$25.00	$50.00
2	Each foot of underground service (special prices if in macadam or paving)	1.10	2.20
3	For service pipe up to 20 feet	6.00	12.00
4	Each additional foot	.30	.60
5	Ground wire	4.00	8.00
6	Service switch	2.25	4.50
7	Basement run	11.50	23.00
8	Meter board	.50	1.00

Or, all items, 3 to 8, inclusive, to be covered by the following figures:

	Cost	List
Service entrance, etc.	$15.00	$30.00
For each extra outlet, add	.30	.60

Standard outlets:

(Standard outlets include ceiling wall, baseboard and floor outlets for current, single pole switches and the bell-ringing transformers.)

	Cost	List
Open wiring	$1.75	$3.50
Wooden moulding	2.60	5.20
Metallic moulding	4.23	8.46
Concealed, ordinary	3.90	7.80
Concealed flexible metallic	5.20	10.40
Concealed armored cable	4.87	9.74

Outlets for double-pole switches, two-point electrolier switches or automatic door switches, 130 per cent.

	Cost	List
Open wiring	$2.28	$4.56
Wooden moulding	3.38	6.76
Metallic moulding	5.50	11.00
Concealed, ordinary	5.07	10.14
Concealed flexible metallic	6.76	13.52
Concealed armored cable	6.33	12.66

Ceiling switch or pilot lamp at location chosen by contractor, 30 per cent.

	Cost	List
Open wiring	$0.525	$1.05
Wooden moulding	.78	1.56
Metallic moulding	1.27	2.54
Concealed, ordinary	1.17	2.34
Concealed flexible metallic	1.56	3.12
Concealed armored cable	1.46	2.92

Pair of three-way switches 320 per cent.

	Cost	List
Open wiring	$5.60	$11.20
Wooden moulding	8.32	16.64
Metallic moulding	13.54	27.08
Concealed, ordinary	12.48	24.96
Concealed flexible metallic	16.64	33.28
Concealed armored cable	15.58	31.16

Four-way switches, or three-point electrolier switches, 160 per cent.

(Four-ways used only in connection with a pair of three-way switches.)

	Cost	List
Open wiring	$2.80	$5.60
Wooden moulding	4.16	8.32
Metallic moulding	6.72	13.44
Concealed, ordinary	6.24	12.48
Concealed flexible metallic	8.32	16.64
Concealed armored cable	7.79	15.58

Heating outlets 200 per cent.

	Cost	List
Open wiring	$3.50	$7.00
Wooden moulding	5.20	10.40
Metallic moulding	8.46	16.92
Concealed, ordinary	7.80	15.60
Concealed flexible metallic	10.40	20.80
Concealed armored cable	9.74	19.48

	Cost	List
For each outlet that involves cutting or dodging hardwood, add	$3.25	$6.50
For each outlet on brick wall, not furred (concealed jobs)	3.20	6.40
For each gang switch, credit for second and subsequent outlets	.65	1.30
Door outlet from bell-ringing transformer	2.00	4.00
Emergency system, one circuit, armored cable	40.00	80.00
Installing switches, receptacles, etc., each	.25	.50
" automatic door switch	1.00	2.00
" bell-ringing transformer	1.00	2.00

For fittings themselves use market price plus general expense and profit.

The following pages indicate how the Information Sheet (page 299) and the Price List (page 318) would be used in estimating on work. It is supposed that the various items specified are taken off an information sheet which has been filled out by the customer, and probably more items are included than would enter into most jobs.

	List	Net
Set-back charges:		
2 poles and stretches of wire at $50.00 each	$100.00	
Less 50 per cent		$50.00
Or 22 feet of underground service, 2 feet free, leaving 20 feet at $2.20 a foot	44.00	
Less 50 per cent		22.00
Service entrance and ground wire, meter board, etc.	30.00	
Less 50 per cent		15.00
Standard outlets in rooms calling for concealed armored cable, all at same price per outlet: 3 ceiling outlets, 8 wall outlets for brackets, 6 wall outlets for receptacles, 3 baseboard outlets for receptacles, 1 floor outlet, 6 outlets for single-pole switches.		
27 outlets at $9.74 each	262.98	
Less 50 per cent		131.49
Outlets for double-pole switches, etc.: 2 outlets for double-pole switches, 1 outlet for door switch, 1 outlet for a 2-point electrolier switch.		
4 outlets at $12.66 each	50.64	
Less 50 per cent		25.32
Three-way switches:		
2 pr. 3-way switches at $31.16 a pr.	62.32	
Less 50 per cent		31.16
Four-way switches, etc.: 1 outlet for 4-way switch, 1 outlet for a 3-point electrolier switch.		
2 outlets at $15.58 each	31.16	
Less 50 per cent		15.58

	List	Net
Heating receptacle outlets: 1 floor outlet for heating receptacle, 1 baseboard outlet for heating receptacle, —		
2 outlets at $19.48 each	38.96	
Less 50 per cent		19.48
Two outlets for pilot lights, location to be chosen by contractors:		
2 outlets at $2.92 each	5.84	
Less 50 per cent		2.92
Outlets in rooms where wooden moulding is allowed: 3 ceiling outlets, 2 wall outlets, 3 wall receptacles, 3 snap switches. —		
11 outlets at $5.20 each	57.20	
Less 50 per cent		28.60
Two ceiling switches $1.56 each	3.12	
Less 50 per cent		1.56
Total number of outlets in house, counting each lamp at one and each heating receptacle at two figures, 34 outlets involving a surcharge of 60 cents each, or	20.40	
Less 50 per cent		10.20
Number of outlets that involve either cutting or dodging hardwood floors:		
3 at $6.40 each	19.20	
Less 50 per cent		9.60
One gang of 3 switches involves a credit on 2.		
One gang of 2 switches involves a credit on 1.		
Total credit on 3 at $1.30 each	3.90	
Less 50 per cent, leaves a credit of		1.95
Installation of one door switch and one bell ringing	Cost	List
transformer at $1.00 each	2.00	
Less 50 per cent		1.00
Installation of 36 receptacles, switches, etc., at 50 cents each	18.00	
Less 50 per cent		9.00

For the fittings themselves take the cost of fittings from the contractor's universal data and sales book or the net cost, varying with the market from time to time, plus allowance for general expense.

Add the various items as follows:

Net cost of set-back.
Net cost of wiring.
Net cost of cutting or dodging hardwood floors.
Net cost of installation of switches and fittings.
Net cost of fittings themselves.
Net cost for installing wall outlets on brick walls that are not furred, total costs less a credit whenever switches are arranged in gangs.
Final net cost.

Now, if each of the items in the job has been covered the total cost should correspond with the total cost of the job, and if the total as figured in the way indicated is wrong, it is because we have made a charge too big or too little for some items. If the user of the lists find that these tentative costs and prices give wrong results, the different items may be adjusted until the total is correct under local conditions for any given class of houses.

It has been suggested that in order to make a given set of unit prices apply to houses of different characteristics an arbitrary charge could be made, as, for instance, $1 per room, a corresponding amount being taken from the outlet costs. This would have the effect of making the price run high in small houses with many rooms and low in large houses with few rooms, and it may be that such a scheme would in practice fit the unit of costs of various classes of houses better than if no allowance were made for the number of rooms.

In spite of the fact that the list has been simplified by averaging a number of items, the calculations are, of course, much too elaborate to submit to a customer. If it were further simplified, however, it would become inaccurate for so many conditions that its value would be entirely lost. The Committee therefore leaves it in this form, and wishes to discuss two criticisms that should be made; one, that it is not accurate for many cases, and the other, that it is too complicated for practical use. To both of these the answer might be made that any such formula or table can be only a compromise. The Committee has endeavored to present it so that even if not used by everyone in its present form, it can yet be made the basis of estimates that shall be practically accurate enough and also simple enough.

In order to determine accurately the cost of a wiring job, it is necessary to know not only the number of outlets, switches, etc., the number of hardwood floors, and the other items asked for on the Information Sheet, but it is also necessary to know just how the locations fit in. A switch on the right side of a door may perhaps work in very conveniently; if on the left side, it may require extra material as well as labor. Furthermore, even if the plans and specifications cover every detail, the cost will vary considerably under the small demands of the customer or the methods of the workmen and other unforeseen items.

When a job is done on the labor and material basis all these things are covered, but when an estimate is given some items must be uncertain and the contractor can only hope that on an average he will be about right. Now, of course, the more information at hand the more accurate will be the estimate, but too much time spent in preliminary work increases costs, and every contractor uses averages to some extent in making up his figures.

The plan here presented is intended for a guide as to the point where exact figuring may wisely stop and averaging begin, and we have set this limit, for small jobs, at the point where information can be procured by the central-station solicitor without the aid of an expert in wiring. In order to show how this will work out we have used definite cost figures, but if these are not correct for a given locality (it would be a wonderfully good piece of work if they fitted exactly any set of local conditions), the contractor or the central station should revise them. For instance, if he can handle hardwood cheaper than the average, he could reduce this item. If the central station in his town puts in the meter board, etc., he could correct this item in the table. If the price of metallic moulding should be cut in half he could revise those figures. In the end he should have the figures to suit local conditions.

The Committee hopes, however, that even without an adjustment of the figures these lists will be useful, and suggests that they be employed as follows:

When the solicitor gets in proper touch with a customer the Information Sheet is filled out and the list-price of the job is figured. The first time the solicitor uses the sheet and list-prices all he will be able to say is that an average cost throughout the country would be in the neighborhood of half these list-prices, or 50 per cent off. At first he naturally would not depend on the Committee's list as being suited to his local conditions, but would get further estimates in the old way. After a little experience he might find that instead of 50 per cent the contractor's estimates were more apt to be, say, 40 per cent off the list; and soon he will be in a position to give the prospect some rough idea of the cost without having a contractor look over each house.

Contractors also should be able to use the lists to great advantage; at first they would figure up a job the old way as well, estimating the total amounts of wire, conduit, etc., etc. They would then compare these figures with the price-lists and arrive at some discount from the lists which would hit pretty close to their estimates based on the number of feet of wire, etc. Then, since even the most careful estimates based on the number of feet of wire and conduit will not show exactly what the cost will be, they may decide that for small and medium jobs they can safely take a chance, and instead of laboriously estimating each job, make a bid of a discount off the list, from the information procured by the solicitor. A comparison of estimates and final actual costs should quickly show a contractor how to make accurate estimates.

Experience may finally indicate that on certain classes of work a lower discount can be figured than on others, and often a contractor can make his own price-list, based on that of the Committee. For instance, if he finds he is able to do well on hardwood floors his private list for the item hardwood floors would be $2.00 instead of $6.50; or if in his district 3-way switches involve a lot more work than allowed for, he will make his list-price higher for that item.

In general, however, the Committee's list is intended merely to help toward a quick, rough, but moderately accurate estimate of the cost. In large jobs it should always be supplemented by a careful estimate based on inspection. For small jobs it should often serve as a basis for a bid. Even as it stands, this list should enable a central-station solicitor with a little experience to save contractors a great deal of estimating, and yet to satisfy the prospect. The discount scheme makes it fairly flexible.

The solicitor could say to a customer, "I can get your house wired for $———, which is —— per cent off the list, but that, for you, would be like buying a ready-made suit of clothes. If you want to go to a contractor who is of the same class as your own tailor he will charge you $———, which is —— per cent off the list." Only in a case of this kind the solicitor can sometimes do still better by advising the customer to have his wiring done on a time and material basis.

In another case the solicitor could tell the prospect that his house would be wired in first-class manner by the Jones Electric Co. for —— per cent off the list, and that it was by no means necessary to pay higher prices unless he wanted fancy as distinct from first-class work.

While useful to an experienced solicitor, in a campaign for getting a lot of old buildings wired the list would be entirely too complicated. For such a campaign the Committee recommends that each central station or contractor simplify the list in his own way.

The following pages indicate how some of the local lists might add clauses to the specifications and thereby simplify the information sheet and price-list. The question of how to define A, B, C and D houses is left open. First, however, are given some specifications for quoting prices direct from the Committee's list.

The following rules apply to all bids made on this list unless otherwise specified.

SPECIFICATIONS

Wiring is to be concealed or in moulding, etc., as provided in the information sheet.

Hardwood floors do not add to the expense unless wires must be concealed in the room below.

Hardwood borders do not count unless they extend more than three feet from the walls.

Receptacles for heating are for 20 amperes and require pilot light, etc.

Unless specially noted, each outlet or ordinary receptacle is figured at 40 watts.

All work and material is to be in accordance with the National Electric Code and the rules of the local city or town inspectors.

The price quoted covers all the work necessary for the items specified, leaving the job complete and ready for use without further expense to the customer, except for the purchase and installation of fixtures.

PRICE

The price quoted for the items as specified on the list of outlets and for conditions as specified on the Information Sheet is $, less discounts as noted, or $ net.

Unless accepted within days the quotation is subject to change.

If accepted, work is to be commenced within days, and finished within weeks.

EXTRA WORK

Additions to or subtractions from the order will be adjusted at the prices quoted, unless the change be made so late as to involve greater cost than if arranged for when the order was placed, and as long as they do not increase the total cost by over 33 1/3 or decrease it by over 10 per cent.*

Any work done on items not covered by the price-lists or that involves doing any of the regular work a second time, or at a time other than when the regular work is done, is to be charged for on a time and material basis.**

Orders for extra work must be given on a written order blank, signed by the customer, stating the work to be done and price to be charged, whether net or based on time and material.

TERMS OF PAYMENT

Terms of payment will be as follows: The agreed percentage of the price when the order is placed; the balance when the work has been completed and connected to the central-station system, or when the central station has certified that the work, except for the installing of fixtures, has been completed ready for connection;

Or

Payment for the full amount when the work has been completed and connected to the central-station system, or when the central station has certified that the work, except for the installation of fixtures, has been completed ready for connection;

Or

Payment for the full amount in   equal instalments as follows:

The first when the order is placed; the second when work is completed and connected to the central-station system, or when the central station has certified that the work, except for the installation of fixtures, has been completed, ready for connection: the remaining instalments monthly thereafter until fully paid.

The simplified specifications might read as follows:

For A, or very cheap houses—

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* In many cases the contractor or central station will be willing to agree to take any additional amount of work at the regular quoted prices. In such cases this limit can be omitted.

** One of our companies working on a price-list allows additional items, no matter how small, to be done at later dates, at the regular prices plus a so-called "go-back" charge in the neighborhood of $3.00 to $4.00; as, for instance, if a customer a week later wants a single additional switch, on which net prices for wiring and material would have been $2.50, the company will send a man to put in this switch at $2.50 plus $3.50 for the go-back charge, or $6.00 in all.

All wires in living rooms will be in wooden moulding.
All wires in bedrooms, attics, etc., will be open wiring on porcelain insulators.

The Information Sheet might omit any reference to 3 or 4-way switches, electrolier switches or special heating receptacles. The price-list could then give a single price for service entrance, ground wire, etc., plus a single price per outlet, plus prices for drop cords, fixtures, switches, etc.; or even a price for service entrance, plus a single price per outlet, with a note that this price includes either a switch, a drop cord or a moulding receptacle for each outlet. Of course, the final simplification would be a fixed sum for a given number of lights, switches, drop cords, etc., any extras, if allowed at all, being taken from the price list; as, for instance, "We will wire your 8-room house complete for $."

Then give the equipment for each of the eight rooms covered by the offer, and have ready a price for various extras, if ordered by the customer when he orders the job; as, for instance, so much extra for each additional bracket outlet. The Committee's list should furnish the basis for getting up simple offers, but the variety is so great that it does not endeavor even to suggest how much further simplification can be carried. If the customer is offered too much variety he is bewildered, but, on the other hand, he may want something just a little different from a standard equipment, and unless he can get what he wants the business may be lost.

For B, or low to medium-priced houses—

Wiring in living room will be concealed, except that any outlet on a brick wall will be from metallic moulding.
Wiring in basement, chambers, closets and attic will be in metallic moulding.

In such cases the local experience might show that the proportion of concealed and moulding outlets would average the same, and one price only need be quoted for each kind of outlet for this class of house.

It might be possible to put all ceiling, wall and baseboard outlets at one price, and have one other price for 3-way or 4-way or electrolier switches and special heating circuits, so that there would be in all but three prices for outlets.

For C, or medium to high-priced houses—

Wiring will be concealed armored cable, except in basement, kitchen, laundry, closets and back stairs, where metallic moulding may be used.

All wires will be No. 12.

Here, as for B, there could be one price only for each kind of outlet, on the basis that the proportion of moulding outlets would be about the same in all houses of the class, and the number of kinds of outlet at different prices could be reduced far below the number shown on the list of outlets that goes with the Information Sheet.

For Class D, or very expensive houses—

All wiring will be concealed in flexible metallic conduit, or armored cable may be used.

No. 12 wire will be used throughout.

Special high-grade fittings will be used throughout.

While wiring price-lists would seldom be used in bidding for very expensive houses, yet they would undoubtedly be of great service in simplifying the estimating; hence, if developed, they should be very complete.

The foregoing discussion has brought us to the point of closing the contract. This may be between the customer and the contractor, the customer and the central station, or all three.

When the central stations stay out of the wiring business and yet solicit new business, it is very essential that they should be able to quote prices, and with any sort of co-operation, either elaborate price-lists like that shown, to be used with a discount, or simpler lists at fixed prices, should enable the salesman in a campaign to quote prices for all the conditions he may run across (except very large houses), receive the contract, and turn it over to a contractor.

PART II

Late in 1912 your Committee was asked to take up the question of standardizing plugs and receptacles. In considering this question the Committee was quickly led to the conclusion that it involves a number of broader questions related to insurance rules governing the installation of heaters, and regulating the number of outlets and number of watts that should be placed on a circuit.

As a result of the investigation the Chairman in his individual capacity, made a number of suggestions to the Committee on the National Electric Code, and at a meeting of your Committee prior to the Code Committee meeting the following resolutions were passed:

The Committee believes that for many installations No. 12 wire should be the minimum size.

The Committee believes that for residences each lamp socket and each receptacle for small devices should be estimated at a uniform wattage.

The Committee believes that the rule providing for a maximum size of fuse of 6 amperes on a branch circuit is impossible of enforcement and that if this rule were changed so as to allow fuses up to and including 10 amperes on circuits of No. 14 wire, and a 15-ampere fuse if run on No. 12 wire, it would be practicable for central stations and contractors to exercise a greater degree of care than is at present possible in keeping the larger fuses off such circuits.

The Committee believes that when small portable devices such as chafing dishes, etc., are used, it is preferable that these be used from the receptacle for small devices rather than from the fixture or key socket or key receptacle, and in order to accomplish this result, that receptacles for small devices should be allowed on lamp circuits without any special penalty. Your Committee believes that this result can best be accomplished by separating the receptacles into at least two classes, one of which shall be known as receptacles for small devices, and that these receptacles shall rank *pari passu* with sockets, in any kind of household installation.

The Committee believes that large current-consuming devices should be approved by the Underwriters only when provided with plugs that will not fit into receptacles for small devices and only when marked "not suitable for use on lamp circuits."

The Committee believes that the dividing line between small devices that may be put out with plugs for small devices and used interchangeably with lamps, should be about 6 amperes, and that this would best be expressed in the rules as 660 watts.

Having in view the present condition of the industry, as indicated by the foregoing resolutions, the Committee feels that this is not an opportune time to attempt to standardize plugs and receptacles, and that it should wait until the situation clears up as between plugs and receptacles to be used with small devices that could be carried around to different parts of the house, and plugs and receptacles for large devices, taking above 660 watts, which it would not be desirable to use in different places in the house unless special preparation were made for them.

It believes it desirable to provide in the Rules that a pilot lamp should be obligatory on all circuits fitted with receptacles for large devices.

It is understood that the Code may provide for a classification of plugs and receptacles in accordance with the foregoing resolutions, and the Committee recommends that this subject of standardizing both the small plugs and receptacles, on the one hand, and the larger-sized plugs and receptacles on the other, be referred to a committee of three for consultation with the Underwriters.

Committee
R. S. Hale, *Chairman*
Mathias Turner
C. S. Walton
W. A. Donkin
C. E. Robertson
W. P. Lyon
C. N. Stannard
P. H. Kemble
W. H. Morton

Reporters to the Committee
W. S. T. Handbridge
J. A. Fowler
A. Oppenheimer
H. R. Sargent
F. V. Burton
Glenn C. Webster
W. E. Robertson

DISCUSSION

Mr. R. E. Campbell, Cleveland, Ohio: The Committee has made a number of very excellent suggestions on page 329 of the Report.

I have in mind an investigation carried on in Cleveland for the purpose of determining the effect of poor interior wiring on lighting and heating service. The results of this investigation bear out these suggestions in a very striking manner. They are summarized as follows:

Service	Average Lighting Load Kilowatts	Volts Drop		Gain by Eliminating Effect of Voltage Drop	
		Max.	Ave.	Percent Gain to Customer in Candle-Power	Percent Gain to Central Station in Current Sold
Industrial	5.1	5.02	2.94	10.4	4.4
Commercial ..	10.9	3.94	3.03	10.8	4.6
Residential ...	0.55	2.08	1.57	5.4	2.3
Grand average.		3.68	2.51	8.9	3.8

With an average connected load of 767 watts in flat-irons, toasters, etc., the average voltage drop for those residences where these appliances were available was 4.35 volts. This is equivalent to 5.68 volts per kilowatt load connected.

The appliance manufacturers have rated their products in steps of from 3 volts up to 7 volts. This gives an allowable range of from 1.5 volts up to 3.5 volts, either side of the rating. These close voltage limits in the ratings of appliances have been adopted by manufacturers because they recognize that the economical and satisfactory operation of a majority of these appliances depends upon the time required to attain a certain heat, and this, in turn, upon the voltage at which current is supplied.

Now, the incandescent lamp manufacturers have rated their product at the voltage which will give the customer the most satisfactory and economical lighting service. Any voltage *lower* than this rating is likely to produce complaints and dissatisfaction.

The bad effects of excessive voltage drop caused by poor wiring, or overloaded circuits can best be eliminated by just such steps as the Committee has suggested.

MR. M. S. SEELMAN, JR., Brooklyn: I believe this Section would be interested in hearing a brief account of the most successful plan of wiring already built houses which we have yet tried out in Brooklyn; and we have tried, I think, pretty nearly every plan that has been devised throughout the country. The conditions so far as houses already built is concerned are possibly as difficult in Brooklyn as in any city of the country. There we have thousands upon thousands of houses, built before the days of adequate wiring methods and cheap electrical current, and we have been working for years at the problem, with no small degree of success, in spite of that fact we have still much to learn.

Less than a year ago we evolved what we call our $49 house-wiring plan. The houses in Brooklyn are rather substantial, and would cost on an average from $200 to $500 to wire and equip, which is more than the average owner of a house seems willing to spend, so we announced this $49 plan. We say to the householder: "Instead of having to spend from $200 to $500 to have electricity installed in your home, you can have it done for $49. Don't wire the entire house right away. Wire the living rooms and the parlor, the kitchen, front hall and dining room. We will do this for you on the basis of $9 down and $10 a month, making a payment that anybody in ordinary circumstances can stand." We advertised this plan extensively in the street cars, newspapers, on theatre programs and through the mail. We have had a flood of inquiries. I have not got the figures at hand, but I can say advisedly that we have had hundreds of inquiries and have closed numberless contracts on the basis outlined.

One noticeable feature of the matter is that while this $49 plan appeals to the house owner to the extent of bringing an inquiry, frequently when the salesmen calls, and we have a staff of salesmen who handle this matter only, the prospect may finally decide to go deeper into the matter, and frequently does wire his entire house. We have the idea, of course, of following up this $49 installation. Although as yet no statement can be made regarding results, it is our intention to keep after these customers and induce them to gradually wire the rest of their houses. As an entering wedge, in cases where it is impossible to get people to spend large sums for the wiring of an entire house, I recommend to you this plan of wiring the living rooms at a comparatively small figure, so small that anybody can afford to pay it.

Mr. Osborne: Of our 20,000 accounts, 16,000 are residential. That is a high proportion, I believe, but we found, some 18 months ago that there were a lot of homes along our present lines not yet using current. Now, in 18 months, with two $80 a month salesmen, we have solicited and connected up better than 750 homes. We charge at the rate of $10.50 for the first two outlets and $1.50 for each additional outlet. The average job runs into about $15, with seven lamps, on an average, connected. We pass these over to the local recognized contractors, and trust the customer for the first payment of 25 per cent down and 25 per cent a month until the bill is paid.

In addition to these 750 homes I think there must be as many more that are wired up by what we call "curbstoners" out West, not recognized contractors, who follow our solicitors up, and go in and cut our price, so that we fully believe we have 1500 customers, additional, by this method.

MR. SEELMAN: I have been asked several questions by those around me in regard to the $49 plan, and I want to supplement my remarks by saying that the price named includes wiring, fixtures, reflectors, lamps and everything complete, all ready to turn on the current, and the work is let to a contractor who agrees to do it on a basis that gives us a profit on each transaction.

MR. T. I. JONES, Brooklyn: I want to add to Mr. Seelman's last statement. The $49 plan in Brooklyn was not conceived to get the customer only. If you study any book on salesmanship, particularly Sheldon's, you will find that the thing to do first is to create an interest in your customer. A desire to buy follows after interest has been created and then the sale results. Now, there are hundreds of people in Brooklyn who, after they had an estimate for wiring their houses at $150 or $200, would not consider it for a minute; but if the husband went home and the wife told him that she could get the house wired for $49 he would look into the plan. Now, this proposition was simply a bait to create that interest. Under the proposition we have closed 91 per cent (I am speaking accurately now, 91 per cent) of the inquiries resulting in contracts in excess of $100. There is the justification of the plan.

Now, of course, when a contractor hears that we are advertising a $49 plan, he goes up in the air and says he cannot live on such a proposition. When I first told them about the proposition, I explained that it was not at all for the purpose of getting contracts at that price, it is simply for the purpose of arousing interest. An agent goes through a house with the owner showing what he will give for the $49, and then asks if he would not like to have an additional outlet here or fixture there, a vacuum cleaner or any of the hundred-and-one other things that a good salesman will always suggest. We always submit two alternate propositions in excess of $49. The plan has worked out admirably. We have a little booklet, called "The

Forty-nine Dollar Household Wiring Plan," but the main point I wish to bring out here is that the proposition is a means to an end.

THE CHAIRMAN: Do you know anything about the wiring of workmen's houses? We have heard nothing about that subject as yet. I will ask Mr. Lyon to tell very briefly of a plan we have here in Chicago, covering that subject.

MR. W. P. LYON, Chicago: We started a campaign some months ago for wiring the homes of men who are employed in factories, foundries and places of that kind, and secured considerable business by soliciting in the factories and foundries. We take them on a basis of $12 for the installation of service. That includes the service, the switch and conduit, the cut-out, and so forth. In addition to that we charge $2.20 an outlet, up to and including 12 lamps and for the extra thirteenth lamp or for the additional circuit we charge $5.00.

I think it was two months ago that we started in and we have secured about 60 of these contracts, furnishing the fixtures on the same basis, so that wiring means complete with fixtures. We wire with steel cable and the average price is about $40.

MR. W. A. DONKIN, Pittsburgh: We started a campaign last year for what you may call workingmen's houses and wired about 1500 houses. About 850 of the connections were made in a very cheap type of house and the average cost of wiring, lamp cords, and so forth, was from $13 to $14 per customer. We allowed them to pay that off in 12 monthly installments, and included these in the bill. No contract was taken for less than $1.00 per month. The total number of houses wired during the year was between 1400 and 1500.

THE CHAIRMAN: The next and last number on the program for the morning will be a paper by Mr. Edwin E. Witherby, of Chicago, on The Central Station's Greatest Opportunity—The Electric Vehicle.

MR. E. E. WITHERBY, Chicago: As a youngster, I once had a teacher who claimed that he was a friend of every boy in the school. At times we all needed a gentle reminder and he used to prefix this by saying, "I am going to give you a friendly licking, but you need it, and it will make a better boy of you." I think there are some of the members who need a "friendly licking," and that is what I am going to give you.

THE CENTRAL STATION'S GREATEST OPPORTUNITY—THE ELECTRIC VEHICLE

Gentlemen, you are going to say at once, "That is a broad statement," but if I prove it, and I am going to do so, then I know you will agree with me.

Unquestionably, the greatest business opportunity is where we get the greatest volume of business. You may have a flat-iron in every house in your territory, a toaster, perhaps a vacuum cleaner, and an occasional washing machine, and some one or two of the many other useful domestic appliances in practically every home, and you smile complacently and look satisfied.

You do not seem to realize as you go from home to office, as you pass the various horse wagons, and there are thousands of them, or a gasolene truck once in a while, that the biggest piece of real business in every man's community is the transportation of people and merchandise, and that at least 50 per cent of all the tonnage that you see every day can be hauled cheaper by electric vehicles than by horses or gasolene machines. Gentlemen, it is the greatest piece of business in the world to-day.

Next, if we can do this work by electricity, it is up to the central-station man to furnish the current, and at such prices as to show a big economy to the one who uses it and to earn dividends for the company. Now, the point I want to start with is that old saying—"practise what you preach." It is a pithy saying, and it is what I want you all to do.

The salesman for a pleasure car or an electric truck has a hard up-hill job to persuade the man or woman who wants a simple and elegant vehicle for personal use to buy an electric car, or to influence the merchant or warehouseman to the purchase of electric commercial vehicles, when the officers and superintendent of the electric company are all driving around in gas cars and are using horses and gas trucks for the work of the central station. And let me emphasize the fact that this is not an idle statement. It is the usual condition, I am sorry to say. Now, I am not taking every central-station man to task on this—there are a few who realize the opportunity and are honestly trying to help the electric vehicle and in this way to help themselves to a big record of increase in business and their stockholders to dividends; what hurts us all is the small percentage of the whole who are helping. I honestly believe that it is less than ten per cent of all central-station men. Now is it not time to change your methods and get in line? I know that it is.

Look at the following charts: Figs. 1 and 2 show an average daily load curve of the Commonwealth Edison Co.; one is typical of a summer, and one of a winter day. Note the change in conditions the electric vehicle load could make if applied, as it will be in the near future. Mr. George Jones in a paper read at the Illinois State meeting stated that "if half of the horses in Chicago were replaced by electric vehicles, this estimated load would amount to 94,000,000 kw-hr. per annum, to take care of which no additional investment in station equipment would be required, and this off-peak would increase the general load-factor 13.2 per cent."

High class engineers have for years worked to produce apparatus that will give great economies. This is more true in the electrical field than in any other class of engineering and they have accomplished something, but the greatest economy has been brought about not so much by change in design as by larger units and better load-factor. In the old days, electric stations operated from dusk in the afternoon until one a. m., or perhaps until daylight, with a load-factor of 5 to 6 per cent. A little later on we ran our plants 24 hours a day, and with a combined railroad and lighting plant we had a load-factor of perhaps 25 per cent and sold current at 20 cents a kw-hr. Now, the universal power in small establishments is the electric motor. Domestic appliances are everywhere. Our generating units have gone from 37½ or 50 kw. to 15,000 or 20,000 kw. and now we are soon to see one of 30,000-kw. capacity installed in the city of Chicago. Load-factor is being improved constantly. We are all looking for the ideal 100 per cent, and our chances are good,—but how? Most of our power motors are cutting out about five or six p. m. and starting at seven or eight a. m. Our regular residence and commercial load is off the lines by midnight (except in New York City), but we cannot turn night into day everywhere and we cannot expect to see the time when all factories will run night as well as day, for workmen will not do it. What we must

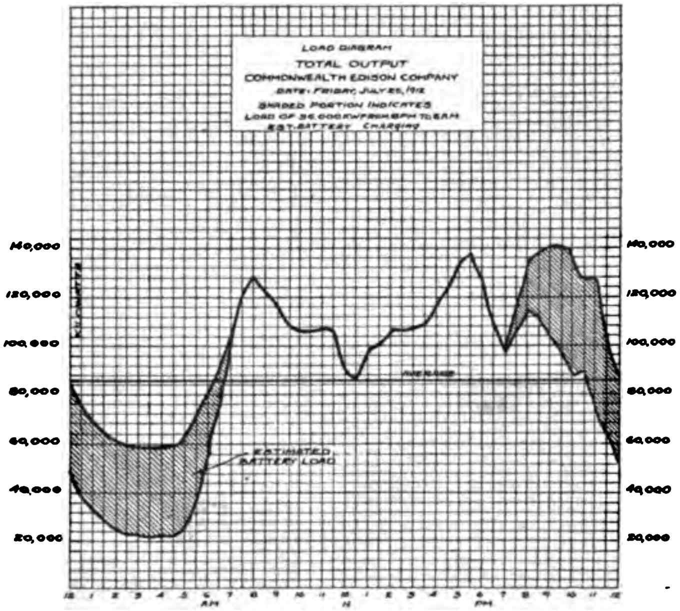


Fig. 1—Typical Summer Load Curve of Commonwealth Edison Company

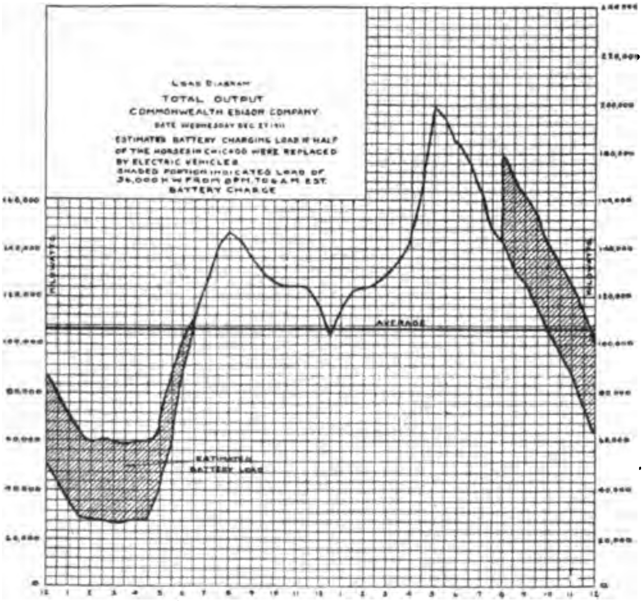


Fig. 2—Winter Load Curve of Same Company

get is a load from ten, eleven or twelve o'clock at night until seven in the morning, and the electric vehicle is the one thing to do it and give the load necessary to flatten out the load curve. The nearer we get to 100 per cent the lower the cost and the greater the efficiency, which means, as stated before, dividends.

You have been thinking so far that I have not proved my case—but I shall. The electric vehicle salesman has convinced thousands of ladies that the electric pleasure car is what they want—the central station did not do it—and thousands of these vehicles are in use to-day and are here to stay. The electric truck salesman has convinced hundreds of up-to-date merchants and manufacturing companies. The result is that thousands of electric trucks are in daily use and they run every working day. These salesmen have increased the revenue of electric light and power companies thousands of dollars annually. Now, what co-operation and help do we get from the average central-station man? I say, emphatically, very little. We thank our lucky stars there are some exceptions and the exceptions are the stations that are now getting the greatest return for help given when we needed it most.

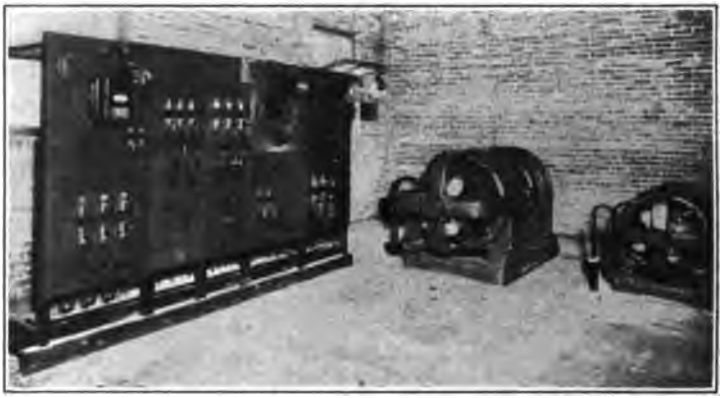


Fig. 3—Charging Equipment of Elite Garage

To prove up again, look at the illustrations of some of the public garages here in Chicago.

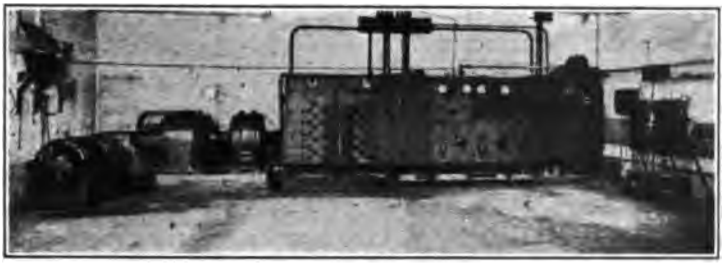


FIG. 4—MOTOR-GENERATORS, RECTIFIERS AND CHARGING PANELS OF TERMINAL GARAGE

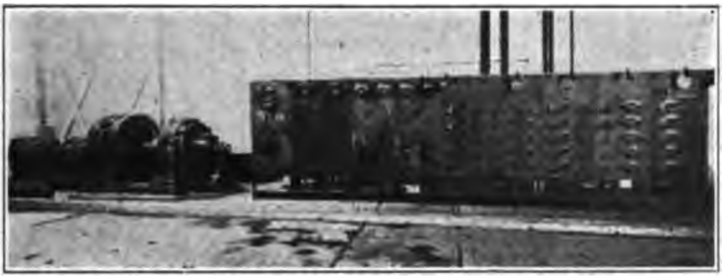


FIG. 5—EQUIPMENT OF CARSON, PIRIE, SCOTT & CO.'S 61ST ST. GARAGE

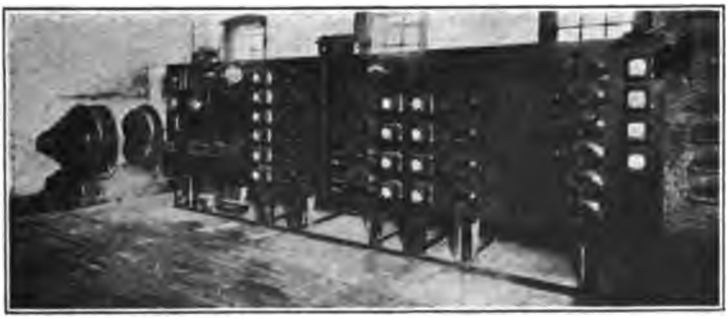


FIG. 6—CHARGING PANELS IN ONE OF THE MARSHALL FIELD GARAGES

The Elite Garage has installed a 25-kw. and a 75-kw. motor-generator set to take care of 100 to 150 electric cars; the Terminal Garage a 25-kw and two 75-kw. motor-generator sets and two 50-ampere rectifiers to take care of 100 to 180 cars; the Lake View Garage a 50-kw. motor-generator set and two 50-ampere rectifiers, to take care of 50 electric cars; the private garage of Carson, Pirie, Scott & Co., a 25-hp. motor-generator set, and one of Marshall Field & Co., a 75-kw. motor-generator set. Marshall Field & Co. will, in time, have in all their garages over 1500 kw. installed. These are just a few of the newer installations now in this city.

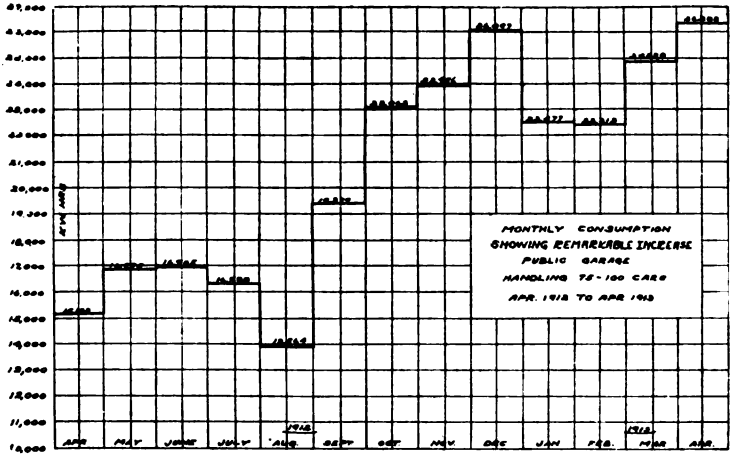


FIG. 7—VARIATION IN MONTHLY CONSUMPTION OF A PUBLIC GARAGE

The Commonwealth Edison Co. has given me all the assistance possible, and please note the returns it is getting. Just take a look at the curve in Fig. 7, showing the monthly consumption of one garage alone and stop and consider this: over 75 per cent of that load is off-peak business, and that is the load you all want.

Quoting further from Mr. Jones' paper: "In Fig. 8 there is shown a daily load curve of a prosperous modern electric garage taking care of from 60 to 75 pleasure vehicles. This garage is being operated by central-station current and under a Limited Hour contract which permits them to do charging at

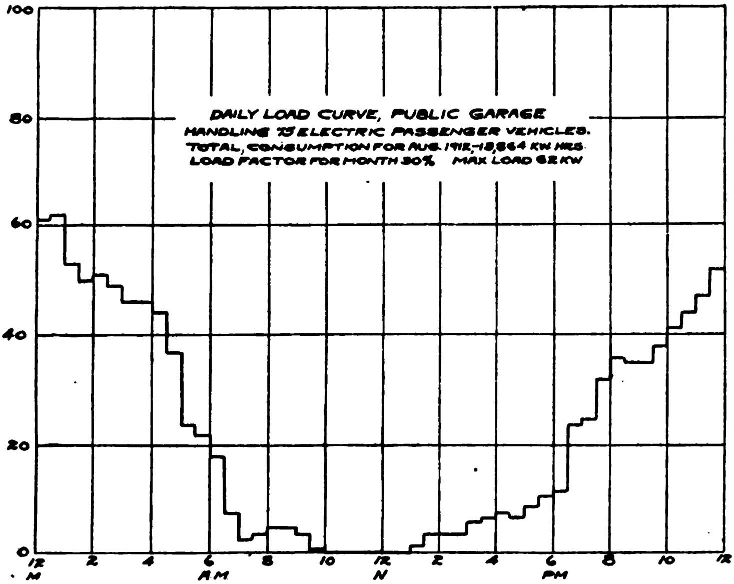


Fig. 8—Daily Load Curve of a Prosperous Garage

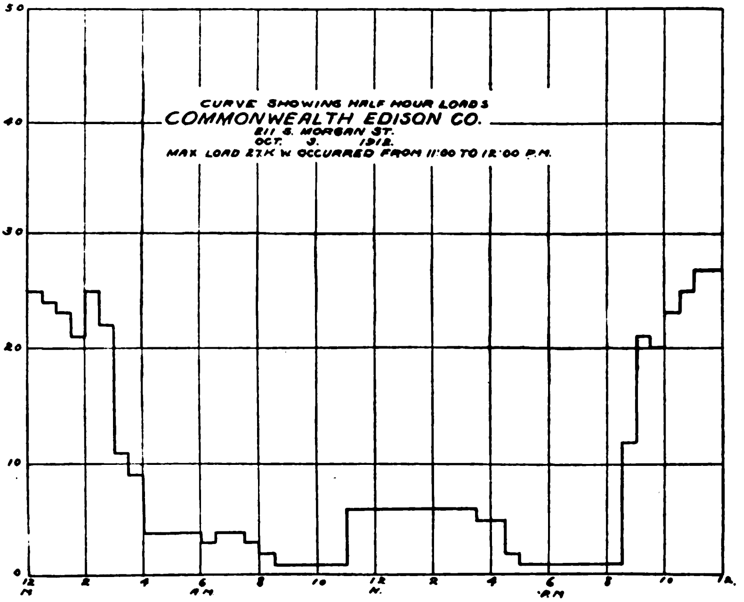


Fig. 9—Load Curve of Garage Charging Electric Vehicles

any time of the day during the summer months, but during the winter months they are not permitted to do charging during time of peak hours of the central station, namely, between the hours of 4:00 and 8:00 p. m."

A garage for commercial trucks would have a somewhat different curve, as a heavy load would be put on at about 8:00 p. m., as shown in Fig. 9, and continue more or less steadily throughout the night.

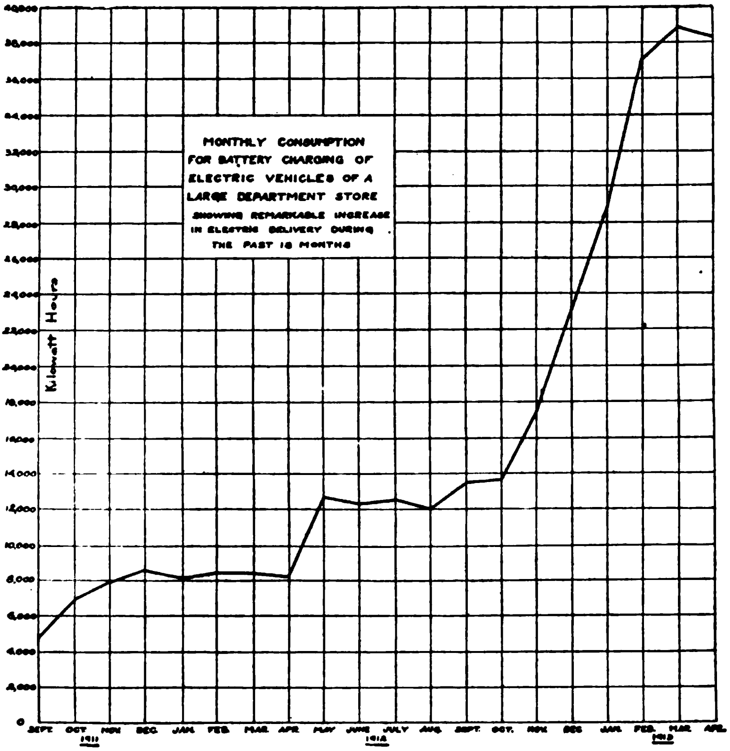


FIG. 10—REMARKABLE INCREASE OF CURRENT CONSUMPTION FOR BATTERY CHARGING IN A LARGE DEPARTMENT STORE

Then, too, a considerable load will be built up at noon for "boosting" and, by the way, this offers almost the only means by which we can hope to fill in the heavy noon-hour depression in the daily curve of all our large central stations.

I will admit that you are not all operating plants in cities like Chicago, but you can all have your proportion of this increase if you will work for it. As an example of the operation take one of our department stores here in Chicago, which has in use and on order 139 electric commercial cars, and has installed and on order 1500-kw. capacity of charging apparatus. The curve in Fig. 10 shows the amount of current furnished to this company for charging purposes alone, and please note the shape of the curve. Is it not a surprise to you to realize that one consumer pays for 39,000 kw. in one month? And, gentlemen, this same department store has a number of electric vehicles on order now and is preparing to add still more. The curve in Fig. 11 shows just how rapid this increase has been. In Fig. 12 the daily load curve of a similar department store garage is shown, illustrating again the off-peak nature of these loads.

Now, another fact: In the city of Chicago there were in use

Nov.,	1910.......	80	electric	commercial	trucks.
Nov.,	1911.......	150	"	"	"
Apr.,	1912.......	263	"	"	"
Nov.,	1912.......	365	"	"	"
Jan.,	1913.......	523	"	"	"
May,	1913.......	647	"	"	"

As the saying is, "that's going some," and the live combinations in this city are hoping to have 1000 trucks by December 31, 1913. Some of us are working for trucks all the time; others are just as hard at work on pleasure cars. While the pleasure car is exceedingly popular with the ladies, the business man is putting it to a broader use to meet his requirements around the city, as the "electric" is the only really practical car for city use.

Some ten years ago I was the owner of a couple of electric cars—a runabout and a surrey—and being a central-station man I supposed I should know all about them because they were electric. I had a lot to learn and it was expensive. Current for charging cost 15 cents per kw-hr. at first, and later 12 cents; and to-day, in most places, you pay 10 cents if you keep your car at home. But in Chicago, in public garages, you pay from 2 to 6 cents, depending upon quantity taken.

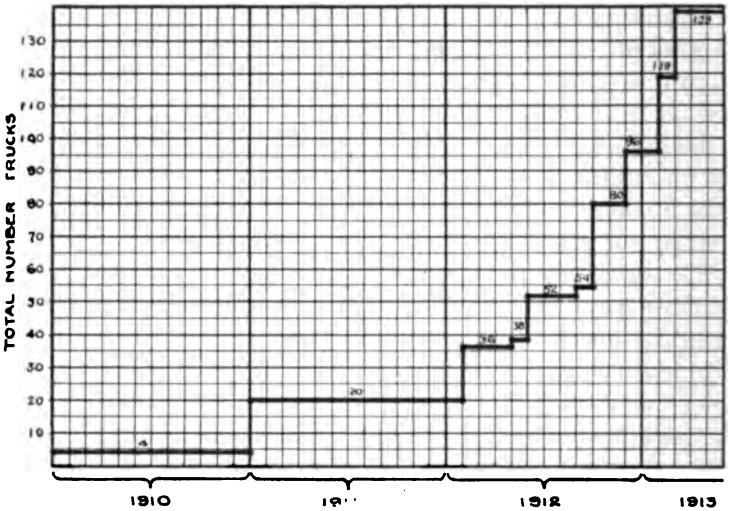


FIG. 11—REMARKABLE INCREASE—ELECTRIC TRUCKS—ONE CHICAGO MERCANTILE HOUSE

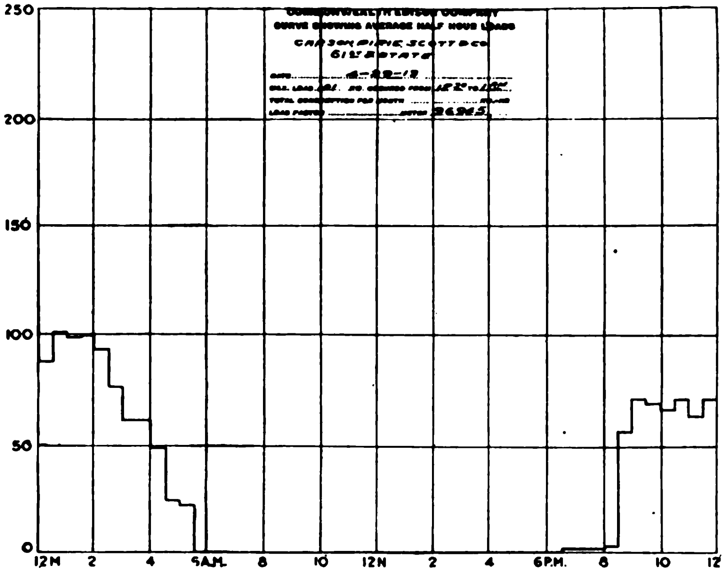


FIG. 12—DAILY LOAD CURVE OF A DEPARTMENT STORE GARAGE

A great many central-station men with small plants look upon the electric vehicle as something that should be shunned instead of encouraged.

At first, we had a pleasure car only, then light trucks, and finally heavy electric trucks up to 12 tons capacity. Great improvements have been made in batteries and greater improvements from an engineering point of view in the construction of electric vehicles and pleasure cars. The result is that we have a vehicle for any class of work desired and each one is, respectively, the best for its class of work; the light, quick delivery, with ease of control, quick to act and making good speed; the medium in weight and speed; and the heavy 5 or 7 ton with its safe and sane speed, that is always ready to do the work required—a large enough line to fit any class of business and a type for every purpose.

Chicago electrical interests have been in favor of electric vehicles for years and are using them to the exclusion of other types of vehicles; Boston has always been a strong advocate; Philadelphia and St. Louis have pushed the electric vehicle constantly, and recently the New York Edison Co. has come very strongly to the front so that to-day in New York City we have nearly 3000 electric trucks.

The big express companies, the American, Adams, Wells-Fargo and others, after a period of try-out of gasolene *versus* electric cars, go in strongly for the electric car for city service, and it is no experiment with the express companies. Extensive investigation and careful checking of results were what determined the final decision. In five years there will be thousands of electric trucks in this one service. Now, tell me, why should the electric light and power man hesitate as he is doing at this time?

Some of the largest fleets are in the brewery interests, one brewery in New York having 112 electric trucks of large capacity, all of one vehicle company manufacture, and the breweries have not gone into this in a wholesale way without a try-out. They have taken years to test it out. The result is that a representative of one of the largest breweries in New York made the public statement at the Brewers' Congress in Boston, October, 1912, that electric trucks were saving his company over $80,000 per annum in delivery service.

Gentlemen, the electric lighting companies in New York did not sell the brewery company that lot of trucks. It was a matter of indifference to them at the beginning, although it is not so now. The electric light company is now on the job every minute and employs some of the brightest brains and business talent in the country to push the sale and use of electric trucks and pleasure vehicles.

Now, if this is good business for New York, Chicago, Boston, Philadelphia, St. Louis, and other of the larger cities, why is it not equally important to every one of you who manages or is responsible for a generating plant and really interested in its success? A late example is one of our British cousins at Vancouver, B. C., which is starting an active campaign by taking the agency of one of the more prominent electric truck manufacturing company's product, has established charging stations in conjunction with all of its sub-stations, and has put on the best talent that could be found to push this very desirable branch of the electric business; and, moreover, is using the electric vehicle in its own service. The Hartford, Conn., Company has also become an agent for a prominent truck and is selling current by the can, as it were, on a flat mileage rate and apparently with big success.

I wish every man here would read the article on page 1040 of the *Electrical World* issue of May 17, 1913, and learn what the Denver Gas & Electric Co. is doing. Some of you here are going to say, "Oh, yes, that is a Doherty company," and he will be correct, gentlemen; for, wherever you find a Doherty company, you will find every man on the job pushing electric vehicles and what is best of all, the company is using them at every point. That organization practises what it preaches. I wish all of you were as consistent.

I could go on and mention a number of other instances, but that is not the point I am aiming at. What I want you all to realize is that I am directly after the manager, the "New Business Man," the chap who is actually responsible for the sale of current in every company in this great country of ours. I wonder if the managers of all operating companies realize that in 75 per cent of the operating companies of to-day the "New Business Man," the real business getter, is more responsible for reduced costs and increased revenue than the engineer at the plant?

As a proof, let me state that 25 years ago we were paying $3.00 and $3.50 per thousand feet for gas and 20 years ago, 20 cents and 25 cents per ampere-hour for electric current. At that time load-factor on the gas plant was less than 25 per cent and it had the advantage of storage facilities. Electric plants had load-factors of 5 or 6 per cent. Engineering and invention have helped, but energetic business methods that improve the load-factor have done more to improve operating conditions and reduce costs than anything else. Why, if load-factor had not been improved we would still be paying $3.00 for gas and 20 cents per kw-hr. for electricity, but the hustling business getter has founds thousands of ways to use electricity, with the result that the peak in many plants is now in the daylight hours and not from 5 to 7 p. m., as in olden times.

In a conversation with the president of a prominent operating company less than a month ago I heard praises loud and long for his salesmen because they had sold on one flat-iron campaign 1878 flat-irons—a big boost to business; and this same man will eventually supersede every horse or gas car with the electric vehicle for the various uses of his company. He is consistent and will help the whole country by his example, having just purchased 12 more electric trucks for his company.

It is easy to figure what flat-irons, cooking and heating appliances and many other things are going to do to help our load-factor. Motors for power, while long-hour business, lap over and increase our peak and in a great many cases increase our investment charges; but current for charging electric vehicles is off-peak business and the "One Best Bet" for fairly large blocks of power, coming on at a time when the load curve is the lowest.

Because I was in the operating end of this business for over 20 years I am now reading this paper. I feel that I can see both sides of the question and I know that more than 60 per cent of the men in charge of properties will not do the first thing to help push the electric vehicle. I know of one place where an express company installed some electric trucks and in a few months had to send them away to another city, because it could not get anyone in the city to take care of them properly; yet the electric light and power company in that city is supposed to be up to date in every way. I might add that this company uses gas cars for its own work. Only last week one of our salesmen wrote from a good-sized city in Ohio as follows: "Mr. W., secretary and treasurer of this company, recently bought a gas truck. He said he had heard a lot about electric trucks but had been afraid to install them, thinking the electric railway, light and power company would have "electrics" if they were economical and reliable." Gentlemen, this is example over again. Practise what you preach.

Some of our central-station men say that the electric truck is too heavy and will not do our work, it takes too much power to move itself; and they do not stop to consider that a 5-ton electric truck with an up-to-date battery will weigh less than a 5-ton standard make gas truck, but it is a fact. The same men will approve of an electric pleasure car so built and arranged that it is carrying only one pound of load for every eight to ten pounds of vehicle, while he will hesitate to use or advocate the lighter capacity electric trucks where we have one pound of load for every four pounds of vehicle. On the 5-ton electric truck we just about balance a pound of load for a pound of complete vehicle, so when we come to real efficiency, we excel in the larger capacities. And 5-ton trucks will, if worked to full capacity of load and mileage, use, on an average, 900 kw-hr. per month or 10,800 kw-hr. per annum, in round figures $450 to $500 per annum current cost. Now, suppose you have 100 5-ton trucks in your city at $500 per annum, that means $50,000 added to off-peak business without a dollar of increase in investment, for labor or depreciation, with only the added cost of coal, water and oil. This, I believe, proves what I said at the start. You are overlooking the one best and biggest thing that it is possible to get.

When the time arrives that it is impossible for a central-station manager to see a wagon load of merchandise passing in the street without mentally translating the impression into terms of dollars and cents revenue from off-peak load, then he will get busy on promoting electric vehicle activities. At the present time most of you are traveling in the rut of old methods and this business is going by you in streams every day without suggesting to you that it rightfully should be and is your business.

In 1910 the railways transported, exclusive of duplication of interchange of freight, 1,026,491,782 tons. Included in the total are manufacturers 278,157,500, miscellaneous 71,600,523, stone and sand 98,861,000, anthracite coal 117,480,501, animal products 38,624,775, merchandise 61,234,757 tons. In transporting this tonnage the railways are using 2,350,000 freight cars, the average load per car being 22.3 tons and requiring 66,000 locomotives. It would be interesting to know just what percentage of the total tonnage was of necessity hauled to and from freight terminals. Possibly 25 per cent of it was trucked twice, perhaps four times, between the point of original shipment and the ultimate destination.

Suppose you should translate these possible ton-miles of truck hauling into terms of kw-hr. and then into dollars of revenue. Why, gentlemen, the amount would seem incredible, but it is a possibility and it is slowly but surely coming. Now let us try to get some of that revenue while we are here, not leave all of it to a coming generation.

The electric vehicle salesman or the manufacturing company he is working for, cannot do it all. In a way we are working for you. We hope to get a sales' profit, but you get a continuous income on the sale of current and of the most profitable kind. Now, will you help, will you do your part as honestly and consistently as we have done ours? We have been at it steadily, forging ahead for ten years—a hard uphill fight. We have convinced the live merchant, the big express companies, the entire brewing industry, but the average central-station man must still be shown the light of day. Gentlemen, I say, from now on will you help and do your part?

DISCUSSION

Mr. Douglass Burnett, Baltimore: This is the kind of paper that makes me feel restless. I feel restless because of the load, I am carrying and because I need help. It is a considerable load, this undertaking to handle electric wagons. All Mr. Witherby says is true. The Baltimore company believes it should take the responsibility of pushing electric cars and pleasure vehicles, but it regrets that it must do so. The great problem in the vehicle industry to-day is to create a method of distribution, to care for these vehicles. Yesterday, we had Mr. Jones' paper on the subject of merchandizing. I want to say right here that it is necessary to apply all the principles of merchandizing to the handling of electric trucks and cars. We must get into this business because there is nobody to get into it for us. It is a great pity that, taking the country at large, there is not to-day any efficient system of selling these cars and trucks outside of the central station. The Baltimore company has unhesitatingly assumed the responsibility of doing this work for the Baltimore territory, insofar as local conditions are concerned. At the time of the fire, our entire distribution and operating department, store rooms and commercial department occupied an old cable railway warehouse. The offices were afterwards taken care of and in the last few years the rest has been moved to a service building, leaving this old power-house vacant. It is a fireproof building, 150 by 200 ft. About two years ago we found that in the whole city of Baltimore, there were but six electric trucks, all operated by one concern, which had been running then for seven, eight, or nine years. We felt the necessity of getting more trucks into service. We bought trucks and put them in this old power-house and then started in to install all the necessary mechanical means of taking care of them. In the period which has elapsed, 100 trucks have been introduced and yet we feel that we are just at the beginning. We are selling trucks, taking care of them, making repairs and selling service. The people in Baltimore buy the trucks, pay us a certain amount of money per month, and we do the rest. This means expenses and it means trouble, but it means also active co-operation, such as Mr. Witherby is calling for. Our great regret is that all of the truck manufacturers are not represented in Baltimore. We cannot hope to have anything like that in the near future, but we would like to see all of them anyway. We have something like 50 agencies for gasoline cars. I think the actual number of gasoline trucks represented by active agents is 44. All of them are willing to unload some of their fixed charges and some of their expenses on the pleasure car, and they are selling gasoline trucks at less than a proper price. The electric company goes to a merchant and says, "We want to sell you an electric truck." A merchant says, "All right. Wait until I see this gasoline man." The electric company says to another, "We want to sell you a truck—an electric truck." The merchant says, "You don't want to sell me the truck and stand back of it, you want to sell me current." Our answer is, "We will give you complete service." There is no argument against that and it is effective. What is the result? The department store feels that it is desirable to use electric wagons. A representative of one of the truck manufacturers comes into town and he makes certain guaranties which we know cannot be upheld. Guaranties are made as to mileage, and so on, and the wagons are sold. In the meantime the lighting company has to bear the selling expense, the garage expense and the work necessary to stand back of this proposition, and yet loses the sale.

I believe that Mr. Witherby is right in calling for the active and hearty assistance of the lighting companies in this work. I believe that some of the lighting companies are willing to give it and are giving it. I want to think that the Baltimore company is doing all that it can do, but at the same time I cannot help but feel that the great trouble with the electrical vehicle manufacturers in this country is that they lack proper means themselves of selling, taking care of and distributing these electric wagons.

MR. W. H. BLOOD, JR., Boston: I think, gentlemen, that this paper of Mr. Witherby's is one of the most comprehensive I have ever heard at any of our Conventions. He emphasizes in the first place the matter of greatest importance, which is that we "practise what we preach." I wish to turn that expression around the other way, and I, therefore, say, let us also "preach what we practise." The central-station men, as a rule, do not talk enough; they do not have, in all cases, the "courage of their convictions." Many of them are using electric vehicles, but comparatively few of them are going out of their way to recommend to the general public the use of electric vehicles. There is a rapid change of sentiment going on all over the country in regard to the use of these. A few years ago only a few of our central stations used them in their business; to-day this condition does not exist. Only a year ago when I tried to secure funds for the campaign of publicity and education for the Electric Vehicle Association of America I approached a manager of a central station for a subscription. His discouraging reply was "If you should give me an electric car I wouldn't ride in it." About six months later I talked with him again, at which time he said, "I think if you would send that electric car around now

I might use it a little." Two weeks ago he subscribed for his company very liberally to this fund and purchased two electric trucks for the general use of his company, and two electric pleasure vehicles for the use of his department managers and solicitors. This is simply typical of the change which is going on throughout the country.

Mr. Witherby has emphasized, and very pertinently, too, the value to the central station of the electric vehicle load. It is not altogether the size of the load which makes it important but rather it is its character. It is naturally an off-peak load, It is not a business which has to be forced out of the off-peak hours, but one which automatically comes on the plant during the hours of light load. For this reason it is imperative that we should do our best to secure it. Besides this, the charging of an electric car is a comparatively steady load, or, in other words, during the hours that the car is charging the load-factor is high and in great contrast to that of a lighting load which necessarily has a high peak. It is a steady load which shows up best on the meter and at the same time requires in the station less generating machinery.

Some prospective users of electric vehicles say, "We cannot use them because the price of current is too high." It is very easy to combat that argument and to show that the cost of current is a comparatively small portion of the total expenses of operating electric vehicles. A little information on this point will help every central-station man to sell electric vehicles.

Nearly all interests are working toward the introduction of electric vehicles. In the first place we have a willing and appreciative public with a large purchasing power; then we have the central station, anxious for the particular kind of load which the electric vehicle brings; then come the electric vehicle manufacturers who are anxious to dispose of their product and also the battery manufacturers who are looking for a broader market. The impetus which the industry is receiving, largely through the influence of the Electric Vehicle Association of America, is cumulative; it is like the proverbial snowball, it is well started, and it is rapidly increasing in size. If you should draw a curve of the increase in volume of a snowball, it would, I think, be very much like the curve which Mr. Witherby has shown in his Report on the increase in the electric vehicle business.

We used to say of something that had a good appearance; "It is a good thing; push it along." The electric vehicle, however, we have just started, and it is now able to go itself. Pushing it, however, will materially help.

MR. J. C. PARKER, Rochester: This paper of Mr. Witherby's I take as a blow between the eyes, and I am so mad about it that I am seeing red. I came up here feeling more or less satisfied with what the Rochester company has been doing with electrical vehicles, but his paper has made me think about what the company is not doing, and as soon as this discussion is over I am going outside of the tent to exercise on myself my mad feeling, which, I hope, will continue until I get home and afterward. We have felt very complacent about this business. We have quite a number of these vehicles in Rochester and have felt alive to the opportunity presented, but, I think, Mr. Witherby is almost absolutely right when he says that the business is unique in the way that it fits into a company's load curve. It is the only class of business which makes off-peak demands. Other classes of business can be made off-peak, but this is essentially off-peak business. We have felt that it was worth while to go after the vehicle business, and to extend it by offering preferential rates for business which comes onto the line during the night hours. We believe in the vehicle business enough to have put a trained engineer on the job two months ago to learn all that he could learn about vehicles so that he could work in conjunction with the companies selling vehicles in the town. We think this is a good thing, too, but there is a lot more to be done. It seems to me it would be a splendid thing for the commercial men to get in touch with their engineers and find out whether they cannot recommend for the company the installation of synchronous motor-generators for use in the large garages. There is not an engineer in the business who is not keen on the necessity of off-setting lagging load-factor. We think it would be a good idea to help the garage bear the cost of this installation.

We find one difficulty with the business; one which perhaps justifies some of the central-station companies in not being in an up-to-the-mark position. The minute a central station starts to take care of vehicles it alienates the affections of every garage in town, and soon will have 35 or 40 garages all boosting the gas car and knocking the electric vehicle. The electric vehicle business must be kept in the hands of the garage people, yet, to do this, places the central station in a dilemma. If it does not delegate the business to the garage men it will be up against cut-throat competition; and if it does, in the mad scramble for business these people make ruinously low prices, the service is not good and the vehicles are damned. The present problem seems to be to see that garagemen are conducting their business on a living wage, so that they can give satisfactory service.

I would like to call the attention of the members who may not have seen the literature to a paper presented two months ago before the American Society of Mechanical Engineers, by Mr. Metz, who is connected with the government printing office in Washington. It was a comparison of the cost of operation of electric trucks and gas cars. This comparison is a good thing to use in advertising. It gives everything concerning the electric vehicle for city use. Our own advertising men have used the information in their advertising space.

I hope Mr. Witherby's paper will have the good effect of preventing a too widespread demonstration of the spirit I went up against two years ago in correspondence asking for some show of interest in the Electric Vehicle Association. I had a reply from the general manager of one company in a not insignificant town who said, "I am not interested in the electric vehicle. The grades in our city are too great to make it practical." The impossible grades in that city consist of the mental habits of the central-station men there; neither the city engineer nor his assistants can eliminate stiffness of that kind.

MR. F. W. SMITH, New York City: As I have listened to the presentation of Mr. Witherby's paper, the question has gone through my mind whether at least a part of that paper was not written some two or three years ago. I must say that I cannot altogether endorse the author's statement that at least 60 per cent of the managers in charge of central stations will not do a thing for the promotion and use of the electric vehicle. This strikes me as a rather extravagant statement, and an unfortunate one.

The paper is somewhat in the nature of a "knock" against the central station by electric vehicle manufacturers, although, knowing Mr. Witherby as I do, I cannot believe he intended it so. It is a very excellent paper in many respects, but in other respects I think it is a little untimely.

The Electric Vehicle Association of America, of which I have the honor to be vice-president, is in a position to give some concrete information as to the support which the electric vehicle is receiving at the hands of central-station interests throughout the country; and when I say that perhaps part of the paper may have been written some time ago, I mean that two or three years ago it might have been correctly stated that central-station companies, as a whole, were not supporting the electric vehicle movement as they should. To-day, however, this is not the case, generally speaking.

I believe, none the less, that the central stations could give the movement still greater support; in other words, the total number of companies that are doing at least something for the electric vehicle is not as great throughout the Class A membership of the N. E. L. A. as it should be.

The Publicity Committee of the Vehicle Association, of which I am Chairman, is about to inaugurate a second year's National publicity campaign. The first year's campaign, which will expire during the coming midsummer, was very liberally supported by central-station companies, contributing, as they did, 58 per cent of the total moneys subscribed for the campaign. The accessory manufacturers came second and the vehicle manufacturers third, with only 13 per cent of the total contribution; so that from the point of view of the Vehicle Association the manufacturers themselves might perhaps be criticized. So far as our Committee has proceeded, contributions to the amount of $25,000 have been pledged toward the second campaign, central-station companies subscribing 60 per cent of the total. The accessory manufacturers are still second on the list and the vehicle manufacturers third. There are approximately 39 manufacturers of commercial and pleasure vehicles, and thus far a relatively small number only have contributed to the fund. Of course, everyone does not endorse the co-operative advertising idea, and some prefer to spend their money directly and in their own way, but those of you who are familiar with the work done by the Electric Vehicle Association will, I believe, endorse the view that there is no excuse for a vehicle manufacturer failing to support our campaign, and that the central-station companies have done splendid work for the good of the cause. The vehicle manufacturers in the past have criticized the central-station companies from the point of view of rates. I am glad to say that this criticism is disappearing. As a matter of fact, the question of rate for current is a relatively small factor in the total cost of operating an electric vehicle, but seldom exceeds 10 per cent of the total cost, and on the average is more nearly 6 per cent. In other words, the point is this: be the rate what it may, the cost of current is a relatively small part of the total operating expense.

While Mr. Witherby gives credit where credit is due by pointing out that the larger central-station companies are giving their active support to the promotion of the electric vehicle, he has failed to give credit where it is due in other directions. Many of the smaller companies are supporting the electric vehicle movement, although these smaller companies cannot be expected to do more than a relatively small part toward advancing the manufacturers' game. One way to advance the good of the cause is first, to believe in the merits of the cause, and second, put your money back of that belief by contributing to the National Co-operative Advertising Fund of the Vehicle Association. It is a method that will bring results.

Mr. Morgan: It seems to me that much of the talk this morning has been regarding trucks. I am not going to tell you who I am or where I am from, but I am personally interested in the pleasure car proposition. There can be no question that trucks mean a bigger increase in business than pleasure cars, but there is one modifying feature that I want to bring up right now. Consider the low-priced electric vehicle for pleasure. There are in this country 45,000 families with an income of better than $15,000 per annum. Only these families can afford a high-priced electric car. There are 70,000 families with incomes of from $5,000 to $15,000 per annum. These are government statistics and I think the figures are correct. You can readily see the advantage of boosting the low-priced car, that is the car selling for less than $2,000. This is a more or less personal boost with me, but I really think you can all appreciate the advantage of boosting the low-priced car because of the tremendous number that can be sold in comparison with the high-priced cars.

Mr. F. D. Beardslee, St. Louis: With reference to part of this discussion and the co-operative feature between central stations and others, I want to recite some of the experience we have had in St. Louis. It appears to me that the smaller stations can handle the electric truck and do it in a way that will not prejudice the dealers against them. In 1905 we felt that the company should get some revenue from electric pleasure cars. At that time there was not a garage in the city capable of handling electric cars and we made an arrangement with a gas garage to install a motor-generator set in the place and have one of our men in attendance. The garage did the washing and handling of the car and we took care of the electrical end. That ran along for a year or more and the company found that it would be better to install an electric garage which it did in connection with a substation. That was kept in use for a number of years and the garage people began to notice that they were losing business. They proceeded to get busy and when they were in shape to handle the cars to our satisfaction and to the satisfaction of the owners the company abandoned the electric garage and went out of business. At the present time we have numerous electric garages, some of them straight electric and others a combination with the gasoline. We abandoned the electric pleasure garage a year ago.

We found it necessary also to get into the truck business and we opened up a truck garage at one of our old stations.

The first of this year we persuaded a man to put up his money and take care of the truck garage, and we notified all of our customers that on and after the first of January we would go out of the business. To-day we are not in the garage business but we are getting good revenue from electric pleasure cars and trucks. As Mr. Witherby has stated in his paper, our company is using a number of electric trucks for our own business and we have just placed an order for 12 more and the old public truck garage is now the company's private garage.

Mr. Hale: It has been stated that we should spend money to put synchronous motor-generators in the garages. If this load is to come off-peak we might better spend that money in another way.

Mr. Parker: In attempting to keep my remarks within small compass I did not make clear the fact that motor-generator sets are installed or operated by the garage men 24 hours a day, and we make an allowance to the garage men for the energy consumed in the loss of power over and above what he would have if he operated the set normally.

Mr. George B. Tripp, Harrisburg, Pa.: I think all central-station men will agree that this is a subject which is very important from the standpoint of increasing the load-factor. Most of the problems which affect the central station operating in the large cities are not the same as those we have to face in cities of from 50,000 to 100,000 people, but I think that ultimately, by persistent effort, we may work out some successful plan to exploit the electric vehicle and particularly the commercial vehicle in cities of the latter class. It may be interesting to know that in Harrisburg we took occasion to spend considerable money in fitting up a charging station in a garage owned by local people. We did this without charge or expense to them, maintaining an operator to charge vehicles at night, and keeping our own trucks there as an example to the prospective customer. In the first place, it is the duty of central-station organizations to use electric trucks for their own purposes. Managers and superintendents should operate electric vehicles, instead of gasoline cars, and this is seldom done at the present time. It does not seem to be necessary for us to reduce rates materially below the power schedules that most of the companies have in effect at the present time, and the current proposition is the least of our troubles. One of the great disadvantages we have been up against is, as has been well pointed out, the lack of support that we have had from manufacturers of electric vehicles. We have also had to struggle against the disadvantage of the low price of gasoline cars as compared with the high price of electric cars. Some such plan as is being tried out in Hartford, Conn., may be the ultimate solution of this situation. This is along the line of the company offering for electric trucks a commercial trucking service, including the charging of batteries at a specified price to the customer. The customer charges the battery daily by simply running the car into the garage and having the batteries connected, something which takes possibly five or ten minutes. That is one of the factors that, I think, should be taken into consideration, and, I hope that something will come of the development along such lines.

Mr. Jones: I should like to ask a question or two of Mr. Parker. As I understand it, the current sales average 1 1/5 cents per kilowatt-hour. I also understood him to say that the reason they put in the motor-generator sets was because they worked 24 hours a day. He allows a certain sum for the loss in the motor-generator set. If the set runs 24 hours a day and you allow a certain amount of loss and give a rate of 1 1/5 cents, what do you get?

MR. PARKER: The man gets a rate of 1 1/5 cents if he installs his own equipment. In case we find it to our advantage to put in a synchronous motor-generator set there are some losses by virtue of the fact that he runs the set 24 hours a day, and those losses are properly chargeable to our distribution losses. There is a slight additional investment caused by putting in such a set, but that we pay for. The customer, therefore, pays exactly what he would pay under a regular schedule without any special arrangement. The rate of 1 1/5 cents is not a preferential rate, it is our regular commercial rate offered for business during the night hours, hence, as you will see, we are not handing him energy without any return.

MR. KENNEDY: It seem to me there is no doubt in the minds of most of the members present as to the value of the electric vehicle load, but in relation to the question of getting that load there seems to be a very serious doubt as to the best method to adopt. Mr. Witherby's paper has one note running through it from cover to cover, and that is, "practise what you preach." I do not see electric companies going to the neighboring gas company when they want window lighting done—they use their own service. When they install a plant to pump water at the generating station they do not go to the Standard Oil Co. for gasoline to run an engine—they use a motor. I cannot see why our central-station men do not realize that the way to obtain the electric vehicle load is for themselves to use electric vehicles. Two years ago I put an expert on this part of our business. At that time we had one electric vehicle, and we started out with the idea of obtaining a load. That expert came to me about once a week and he would report to me what people said: "Why don't the electric companies use electric vehicles?" There is no answer to that question. Where automobiles are used at all they should be electric vehicles for central stations. I know very well the limitations of the electric vehicle and I am not advocating its use for all purposes, but I do advocate its use by electric companies to show confidence in the business they are trying to develop. This electric vehicle load is not going to be handed to anybody on a silver platter. The most effective weapon in the hands of the gasoline automobile men is this fact that central stations do not use electric vehicles themselves. My company is progressive. We have over 20 electric vehicles at present, and are adding to them from time to time. But we have 110 machines in all and we should have at least 50 electrics. Something has been said about advertising. If by any means the Vehicle Association could advertise within the ranks of central stations themselves to beat down this opposition to the use of electric vehicles, that is the kind we need most. From presidents, general managers, superintendents and salesmen there seems to be general opposition. A favorable movement is growing, but it is growing much too slowly.

Mr. R. G. Gentry, Denver: I have no criticism to make on Mr. Witherby's paper, I think it is the best paper on the subject I have ever heard. For a number of years in Denver we have had an expert on electric vehicles and he has done excellent work. He is interesting dealers and the automobile manufacturers and prospects in a most wonderful manner along the line of putting in electric commercial trucks. This matter of co-operating with the central stations and the manufacturers is a most important one. As to practising what we preach, the Denver company has something over 30 commercial trucks and a number of pleasure vehicles which are used in transporting managers and foremen from place to place. The surface of the work has only been scratched, however. Mr. Witherby's paper is right to the point.

Mr. E. F. Lawton, Hartford, Conn.: It has been stated to-day that Hartford is selling current by the can. We are. Until I heard the expression, however, I did not realize that that was what we are doing. About a year and a half ago Hartford awoke to the fact that no electric trucks were being handled or sold there, Gasoline cars were getting all the business, and we decided it was about time to start something. We realized that it was going to be a difficult task to show the merchants that an electric truck is a commercial proposition and a practical thing, for the reason that, in the first place, the cost is greater than for the gasoline vehicle, especially if he owns the battery.

In order to push the thing along we decided that we would own and charge the battery and furnish it to the owner of the car upon demand. We did not want to do it and we hope we shall not have to do it always, but in order to push business along we have undertaken it. After taking six months to get the batteries on hand, we have sold and are now operating about 40 electric vehicles in Hartford, where there is a population of 100,000.

Mr. Witherby: First, I feel that an explanation for giving this paper at this time is necessary. In the early advance program sent out officially by the Association there was no mention of anything pertaining to the electric vehicle, either truck or pleasure car, proving, as I have stated before, the feeling of indifference among central stations towards this particular line of activity. We, who are so active in promoting this work in western territory, felt the necessity of bringing it more prominently to the attention of the central-station interests at this meeting. That is the reason for this paper, so hurriedly prepared.

Another point:—We advertised by distributing cards announcing that the Chicago Section of the Electric Vehicle Association of America was giving a luncheon on Tuesday, and we asked everybody to be present. Out of the total assembly of probably 3000 people, 70 attended the luncheon and it was free, at that.

Mr. Parker says that the electric garage under the control of the lighting company should not compete with privately owned garages. That is all right, up to a certain point, but how many men in this assembly would be willing to have a prominent express company bring trucks into the town, and because the electric light and power company insists that it must remain neutral and not help the thing along, be compelled to leave them in the care of the private garages? The result of one such occurrence was that the trucks were taken out of the city, taken to another city, and put into operation there by the same express company, and all because the central station would not co-operate. There are times when patience ceases to be a virtue, and this is one of them. Mr. Smith takes exception to my statement that 60 per cent of the central-station people are apathetic in this matter. Now Mr. Smith lives in New York, and New York is a pretty good place, I used to live there and I hope some time to go back, but at the present time my activities are west of Pittsburgh, and I have kept a very careful check on the central-station men in this western country. Seventy-five per cent of them are against electrical vehicles, or, at least, indifferent.

As to what the central-station men can do—let the horses go and the gasoline cars go, and put at least one electric car into your own service.

(Adjourned.)

FOURTH COMMERCIAL SESSION

THURSDAY AFTERNOON, JUNE 5

THE CHAIRMAN, MR. E. W. LLOYD: We will take up the first number on the program for the afternoon, which is the Report of the Committee on Refrigeration, Mr. George H. Jones, of Chicago, Chairman.

REPORT OF THE COMMITTEE ON REFRIGERATION

IN GENERAL

During the last few years central-station men in all parts of the country have come to understand pretty fully the marked effect that a high annual load factor has on reducing unit output costs, and are, therefore, very desirous of securing those classes of business which will tend to bring up the load factor. They realize more than ever before the necessity of building up the valleys in their load curves, so as to enable them to secure the highest possible output from their generating equipment. Those classes of business, therefore, which require electric service at times when the central station has plenty of excess capacity are especially attractive, and a great deal of thought and effort can well be expended in securing a load of this kind.

One of the important lines of business which comes under the above head is that of refrigeration. Artificial refrigeration plants have been familiar to the general public for a great many years, but up to comparatively recent times they have been confined to large steam-driven plants used in either the manufacture of ice or in cold-storage warehouses.

The advent of the electric motor and the availability of central-station service at all hours have made possible the wide use of refrigerating apparatus, so that at the present time it becomes a part of the standard equipment of practically every class of modern building. We find machines of this kind in cold-storage warehouses, office buildings for cooling drinking water, etc.; department stores, apartment buildings, residences, hospitals, hotels, restaurants, meat markets, etc. The advantage of artificial refrigeration has recently been pointed out for use on farms in the care of eggs, milk and butter, and also for preservation of fruits and vegetables. Artificial refrigeration is also used in the cooling of many of our large halls and hotels, and, in fact, there is hardly a limit to its possibilities.

A more recent development of the use of central-station power in this class of business is in connection with the manufacture of ice in large quantities, and this is a very important field for central-station exploitation as it involves the use of large blocks of power during off-peak hours, and at a high annual load factor. This has already reached such proportions that last season in one city alone there were manufactured 100,000 tons of ice with central-station power.

There is no doubt that in some cases it is more desirable for the consumer to install his own refrigerating equipment, while in other cases it is better for him to purchase his ice from the large dealer. Either situation gives a good opportunity for the use of central-station power.

MECHANICAL REFRIGERATION

There are some lines of business in which it is evident that the installation of a refrigerating plant will give better results, as, for instance, installations requiring the refrigeration of show-cases and windows, those requiring the maintenance of very low temperatures, and those in which different degrees of temperature are required for different classes of service.

Some of the advantages of mechanical refrigeration are as follows:

(1) Lower temperatures obtained with refrigerating machines than with ice.
(2) Absence of the dirt and muss often accompanying the use of ice.
(3) No accumulation of slime in the refrigerator.
(4) Refrigerators cooled mechanically are dryer than ice-cooled boxes because the moisture in the air deposits on the cooling pipes and is frozen.
(5) Any desired temperature can be obtained and maintained.
(6) Show-windows and show cases refrigerated mechanically at any desired temperature, thus permitting an attractive display of perishable goods.

THEORY

As it is impossible within the limits of this report to go into the details of the theory of artificial refrigeration, reference will be made to a number of standard works, the titles of which are given in Appendix A. In general it may be said, however, that almost all methods of obtaining refrigeration are based upon the fact that when a liquid evaporates or turns from a liquid into a gas or vapor, it absorbs heat from its surroundings. There are a number of liquids which are easily made to evaporate and produce this cooling effect, and but for their cost, refrigeration could be very simply produced by supplying a steady stream of the liquid and allowing the vapor or gas evaporated to escape into the atmosphere. A refrigerating machine is practically an apparatus for saving this gas which has evaporated, and returning it to its liquid form to be used over again.

In this process of recovery and condensation the gas gives out the heat which it has previously absorbed in evaporating. This heat is carried away by flowing water which absorbs it. The operation of a refrigerating machine thus causes a continuous cycle of evaporation, recovery and condensation.

Compression System

There are two general systems in use for producing refrigerating effects, the compression and the absorption. In the compression type the recovery of the gas is effected by drawing it away from the point where it has been evaporated and pumping it under increased pressure into a chamber where it gives out its heat to the water-cooled walls of the chamber and returns to the liquid state ready to be used over again. A number of liquids have been used in the compression type of refrigerating machines, those common being ammonia, carbon dioxide and sulphur dioxide.

With carbon dioxide the advantage is in its lack of offensive odor. Its disadvantages are the extremely high pressure at which it works (300 to 1200 lb. per sq. in.), the difficulty of holding these pressures, and also the difficulty of finding small leaks because of its lack of odor.

With ammonia the advantage is the lower working pressures, which are easier to deal with (15 to 300 lb. per sq. in.). Then, too, leaks are easily detected by the odor.

With sulphur dioxide the advantage is that it operates at very low pressure (not above 75 lb. to the sq. in.). Its great disadvantage is that with moisture it forms an acid which rapidly corrodes the apparatus. At one time this disadvantage was fatal, since with the old type of machine air and moisture were constantly being drawn into the system more or less rapidly, and mixed with the sulphur dioxide. This difficulty has recently been overcome by the Audiffren type of machine in which the refrigerant is hermetically sealed into the machine and chemical action therefore cannot occur.

Absorption System

In the absorption type of refrigerating machine ammonia is generally used and the recovery of the gas is effected by bringing it into contact with water with which it unites chemically. The solution thus formed is pumped into another chamber where the ammonia gas is driven off again by heating the mixture, which is then condensed under high pressure.

In the absorption system the liquid ammonia as it is released by the expansion valve passes into the low-pressure portion of the apparatus, the expansion piping, which is located at the point where the cooling is to be done. While expanding, the ammonia absorbs heat as it passes, and is carried along to the absorber. This is a vessel of cold water. The strong affinity of ammonia gas for water causes a ready combination, and a constant sucking is produced tending to reduce the pressure in this section of the apparatus, thus permitting the expansion of the ammonia gas. After being absorbed, the weak ammonia is pumped into another compartment called the generator, where the ammonia gas is driven out of the water by heat. The hot ammonia gas is then passed through a condenser to be liquefied. The condenser is a series of pipes arranged in vertical rows and cooled by flowing cold water. The liquefied ammonia is collected in the ammonia receiver to be again used through the same cycle of operation. The hot liquor (water) from which the ammonia has been boiled is pumped out, cooled and again used in the absorber. While this system may under certain circumstances be used to advantage, it is more complicated than the compression system, involving higher investment and taking up more space, and, furthermore, it requires an abundant supply of cooling water.

Refrigerating Machines

Refrigerating machines are now on the market having capacities as low as 1/4, 1/5 and even 1/8 ton of refrigeration. The price of this apparatus is such as to be attractive to owners of residences costing $20,000 and upwards, and also for all classes of commercial installation. Recent developments in this class of machinery overcome the particular mechanical difficulties in applying refrigerating machines to smaller service, such as domestic installations, etc., while with the use of one type of machine on the market ammonia is avoided, and the necessity for stuffing boxes and pipe joints is done away with. The limitations in the application of this class of machinery are now practically the noise of the motor and the noise of the water and brine circulating in their tanks. This can in most cases be overcome by properly locating the apparatus in the basement of a building so the noise can be confined.

Machine Rating

While the capacity of refrigerating machines is generally expressed in terms of the effect produced by the melting of a certain amount of ice per day, we suggest that in meeting the average customer it is preferable to state the machine capacity per hour instead of per day, since this immediately suggests the possibility of running the machine as many hours as may be necessary to produce the effect required. For instance, a machine that will produce 16 pounds of ice melting effect per hour may fulfill the requirements of some particular case in 4 hours, producing practically 65 pounds of ice melting effect in that time, whereas if this machine were referred to as having 1/5-ton capacity per day the customer would immediately think of it as too large for his requirements. This plan, of course, involves the use of a brine storage tank to maintain the proper degree of refrigeration when the machine is not running.

Size of Machines

The figures used in determining the size of refrigerating machines required for given work ordinarily give the result very much too small. Figures determined as follows will check very well with practise: Heat enters refrigerate compartments (1) through the walls, (2) in warm goods, (3) by the interchange of air with the outside through the opening of doors and by air leaks, since the cooled air is the heavier and immediately flows out when a door is opened, (4) from lamps or the heat of the bodies of the workers, (5) from any change of state occurring in the goods such as freezing, fermenting, etc.

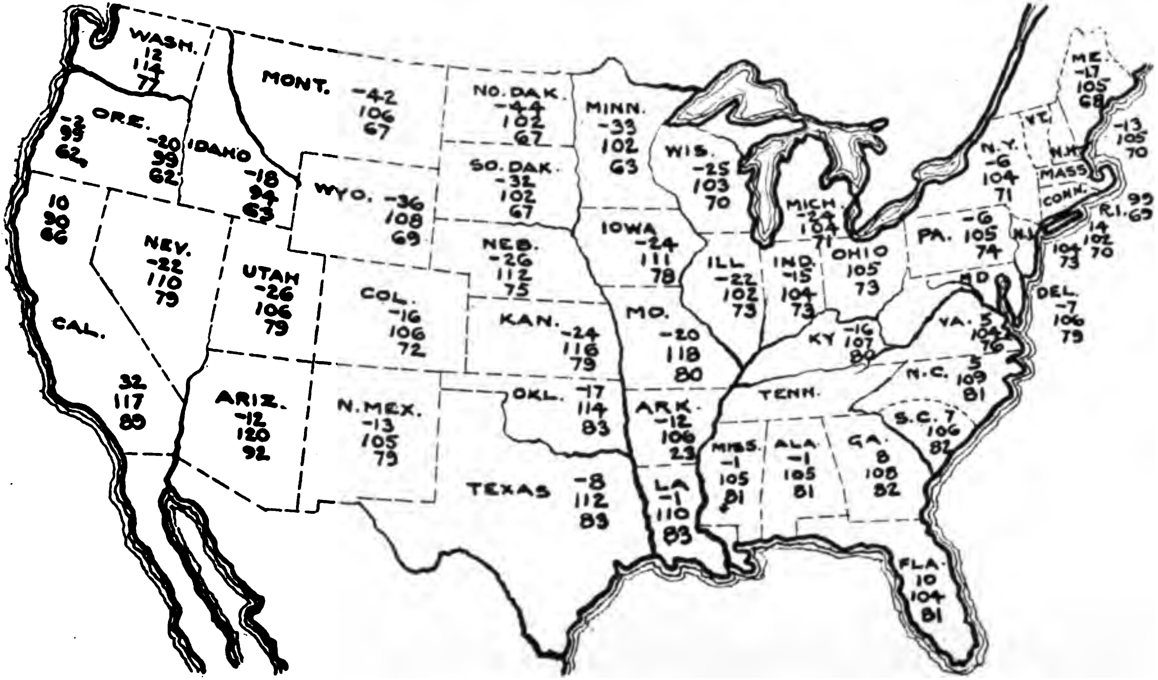
In large rooms these various sources of heat should be analyzed separately. In small refrigerators, as, for instance, hotel, kitchen, domestic refrigerators, etc., a rough rule that is quite as accurate as a more elaborate analysis allows a certain number of B.t.u. per cu. ft. of refrigerated space per 24 hours. This amount varies with the character and location of the box, the nature of its insulation, the temperature desired, and so on. It will be seen that the insulation while of great importance is not by any means the only important factor in this class of boxes. For domestic boxes held between 35 deg. and 50 deg. fahr. allow 300 B.t.u. per cu. ft. of refrigerator per 24 hours. For boxes in hotel or restaurant kitchens allow 600 or even 900 B.t.u. in extreme cases and where low temperatures are required. For butchers' coolers or large storage boxes in hotels, etc., allow 200 to 250 B.t.u. per cu. ft. per 24 hours.

A check on the above figures for the larger type of boxes may be found in John Levey's Refrigeration Memoranda, page 41, published by Nickerson & Collins, Manhattan Building, Chicago.

With small machines it is necessary to allow a greater capacity of machine for a given size of box than with large, since in the latter one can always throw a large part of the capacity to any given box where special need may exist, whereas to do this with the small machine would almost certainly rob some other box, if indeed there happen to be another. It is never possible to determine with mathematical certainty exactly how much refrigeration is required for a given case. It is best to allow for this fact and be sure that the machine is amply large.

Where an existing ice-cooled box is to be cooled mechanically one check upon the size of machine required is the amount of ice used. This check is more apt than any other, however, to lead to erroneous conclusions unless the figures are properly analyzed. The following method, while apparently cumbersome, gives good results: (1) Determine the ice consumption for the hottest month of a year. This will give the average ice consumption for this month. (2) Determine accurately the average temperature that is secured in the box with ice. This will usually be from 55 to 65 deg. fahr. It is commonly stated anywhere from 40 to 45 deg. but these figures are so seldom obtained as practically to warrant the statement that they are never reached. Even if they are secured at all with a full ice chamber and the box closed for long periods, the average will be well above them, therefore, unless positive assurance is had to the contrary, figure on 55 to 60 deg. fahr. as the average temperature.

(3) Calculate the heat inflow through the insulation with a temperature of 55 deg. in the box and with the *average* summer temperature outside.



MAP OF TEMPERATURES

MINIMUM WINTER, MAXIMUM SUMMER, AVERAGE SUMMER

FIG. 1

The difference between the heat inflow through the insulation and the total actually absorbed by melting of the ice is the amount entering the box from other sources than through the insulation. This access of heat ordinarily occurs during the daytime hours only; *i. e.,* when the box is being opened, since at night the box will remain closed.

A machine of sufficient capacity to produce the temperature actually obtained with ice must, therefore, be of larger rated capacity than that indicated by the actual ice consumption. How much larger can be determined by the above method.

(4) A further fact to be taken into account in determining the proper size of machine is that temperatures obtainable with ice are not satisfactory. If they were satisfactory, the greatest reason for putting in cooling machinery would be done away with. Where 55 deg. are obtained by ice, 35 to 45 deg. will be required with mechanical cooling and the machine size must be further increased in the ratio of the temperature differences between average summer temperatures and 35 deg., and average summer temperatures and 55 deg.

(5) Further, the cooling machine if installed in accordance with these figures would handle average weather conditions, but would not be adequate for extreme hot weather conditions, the most important condition to be met by cooling machinery. It is necessary, therefore, to further increase the size of the machine in the ratio of the difference in temperature between maximum summer temperature and 35 deg., and average summer temperature and 35 deg.

(6) One further allowance should be considered; namely, the fact that in many cases, for one reason or another, it is not possible or else not desirable to operate the machine except during certain parts of the day, and the machine size must be increased as much as may be required to take care of these conditions.

(7) Finally, if the machine is not placed directly at the box to be cooled, allowance must be made for the heat inflow into the insulated brine mains. The amount of heat entering from this source is often of considerable importance, particularly with small machines.

The following table gives heat transmissions for cork pipe covering:

PIPE COVERING

Transmission in B.t.u. per 24 hours, per lineal foot for one degree temperature difference between inside and outside of:

Size of Pipe in.	Bare Pipe		Cold Water Cork Cover		Ice Water Cork Cover		Brine Cork Cover	
	O.D.	B.t.u. in.	O.D.	B.t.u in.	O.D.	B.t.u. in.	O.D.	B.t.u. in.
½	0.84	9.50	2.62	5.76	3.25	3.84	4.25	3.37
¾	1.00	11.88	2.85	6.00	3.75	4.00	4.75	3.53
1	1.31	14.81	3.31	6.39	4.25	4.26	5.31	3.73
1¼	1.66	18.77	3.75	7.17	4.62	4.78	6.31	3.87
1½	1.90	21.49	4.00	7.90	4.75	5.27	6.90	3.96
2	2.37	26.80	4.62	8.82	5.31	5.88	7.25	4.44
2½	2.87	32.46	5.12	10.47	5.62	6.98	7.87	4.84
3	3.50	39.58	5.62	10.95	6.62	7.30	8.87	5.20

Water and Milk Cooling

Mechanical refrigeration as applied to cooling water and milk usually has one feature different from other classes of refrigerating work. This is the fact that a large quantity of cooling effect is called for in a brief interval of time. For instance, in a drinking-water system the heaviest requirements may come at the noon hour. In a bakery also the demand for chilled water will be intermittent, a large quantity of water being required for the dough mixing. In dairy work the milk must be cooled very rapidly to check the development of bacteria, which grow with incredible rapidity within the temperature range from 110 to 50 deg.

To install a refrigerating machine large enough to produce the required cooling effect, as it is needed, would call for a very large machine in most cases. This is overcome by using a smaller machine and allowing it to operate for a longer time, say, throughout the day, storing the refrigerating effect produced by cooling a large body of brine or melting the ice as rapidly as may be required. For instance, if 100 cans of milk (40 quarts each) are to be cooled from, say, 75 to 35 deg. in one hour, the refrigeration required will be 100 cans x 40 qts. x 2 lb. per qt. x (75 deg. — 35 deg.) equals 320,000 B. t. u. Note: The milk is treated in the calculation as having the same specific heat as water, since water forms so large a percentage of its total weight. This amount of refrigeration produced by a machine running 12 hours per day would require the machine to absorb 320,000 divided by 12 equals 26,600 B.t.u. per hour.

The quantity of brine necessary to store the cooling effect may be calculated closely enough for practical purposes by using the following approximate figures: Specific heat of brine equals 0.75. Weight of the brine, 9 lb. per gallon. Permissible temperature range of the brine depends on the conditions and may be from, say, 30 deg. to 15 deg. fahr. or lower. In other words, the temperature to which the brine can be permitted to rise is limited to the temperature it must produce in the room or in the substance being cooled, and the temperature to which the brine can be cooled in storing cold is limited by the decrease in economy of the refrigerating machine at the low temperatures.

DESCRIPTIONS OF TYPES OF MACHINES

As noted in the foregoing, refrigerating machines which are at the present time commercially successful may be divided into two classes, compression and absorption. Both types have been explained above.

(A) The compression-type machines fall into three classes:

- (1) The open type, which is made both vertical and horizontal, and both single and double acting (that is, compressing the gas at one end or both ends of the cylinder).
- (2) The enclosed type, in which all the moving parts of the compressor proper are enclosed within the frame of the compressor, except the fly-wheel and the main shaft, which enters the frame of the machine through a stuffing box. Such valves as are required in the system are also exposed.
- (3) The Audiffren type, in which all the working parts of the machine are enclosed in a hermetically sealed container, there being no joints, no stuffing boxes, and no valves that can by any possibility leak.
  - (a) The open-type machine has the advantage that any lack of adjustment due to wear can be readily corrected, and if the attendant has the skill and inclination to give the machine proper attention it will give excellent results. For large installations this is the preferable type of machine.
  - (b) The enclosed-type machine resulted from the effort to reduce the care required by the open machine, to cheapen its construction and to reduce

the possibility of trouble from inexpert tampering with the parts. The difficulty with this type of machine is that when adjustment does have to be made the working parts are very inaccessible. The design is such that wear is apt to be rapid, especially on the cylinder walls, so that the capacity and efficiency of the machine rapidly fall off. How much this deterioration is, it is always difficult to determine. Further, the greatest sources for loss of ammonia and of objectionable odors, *i. e.*, stuffing boxes and pipe joints, are still essential parts of the construction.

(c) With the Audiffren type of machine, the loss of refrigerant is absolutely prevented by the hermetical sealing of the apparatus. The refrigerant used, sulphur dioxide, has a much lower working pressure than ammonia, so that it is an easy substance to retain in the machine. The working parts of the machine being completely enclosed, are absolutely protected from deterioration due to outside causes and from unskilled tampering. The wear is reduced to a negligible quantity by a system of lubrication in which the important working parts, especially the cylinder, are constantly having oil forced between all contact surfaces by a strong pressure. Metal to metal contact is reduced to a minimum, and the wear is, of course, similarly reduced. The machine operates to compress the gas under almost theoretically perfect conditions, and is beyond the control of the person in charge, no matter how skilled or unskilled he may be. With the ammonia type of machine these conditions are difficult to produce, and are, in fact, very rarely produced even by the most skillful engineer handling the most perfectly designed installation.

(B) The absorption type of machine is of two kinds, which differ principally in the matter of proportions of the parts. In the one machine high-pressure steam is used, in the other the proportions are such that low pressure or exhaust steam may be used. In some cases, where large quantities of exhaust steam and an abundant supply of cooling water are available, these machines prove very economical. All absorption machines, however, are subject to rapid deterioration of the pipe coils in the generator, to losses of refrigerant from defective or leaky pipe joints, as in compression machines, and from certain difficulties peculiar to this type, such as foaming in the generator, which results in what is called a "boil over," and which practically puts the machine out of service for the time being.

COLD STORAGE TEMPERATURES

One of the great advantages of mechanical refrigeration is that any degree of temperature can be maintained to suit requirements. This is a very important point, as it is found that, in general cold-storage practise it is necessary to maintain different degrees of temperature for different classes of goods. This is set forth in the following table.

	Degrees Fahrenheit	Specific Heat
Beef	36-40	.68 (fresh)
Hogs	29-32	.51
Lamb and mutton	32-36	.67
Veal	34-36	.70
Meats (in pickle or brine)	35-40	.54-.58
Butter (must be kept separate from other goods)	0-38	.64
Eggs	29-32	.76
Cheese	32-34	.64
Lard	38-40	...
Poultry (to freeze)	5-10	.78
Poultry (when frozen)	25-28	...
Game (to freeze)	5-10	.80
Game (when frozen)	25-28	...
Fish (retail fish counters should be cooled with ice rather than mechanically)	25-28	.82
Oysters	33-45	.84
Beer	33-42	.90
Wines	40-45	.90
Cider	30-40	.90
Fruits	33-36	.92
Vegetables	34-40	.91
Canned goods	38-40	...
Flour and meal	40	...
Furs	25-32	...
Brine for ice cream freezing	5-10	...
Ice cream (air hardening)	5	...
Ice cream (serving temperature)	14-16	...

ICE MAKING

During the past year there have been in successful operation a sufficient number of electrically operated ice plants to prove beyond question or doubt the practicability of central-station service for this class of business. This opens up a very attractive field, as these plants generally require the use of between 100,000 and 200,000 kilowatt-hours per month, and that, too, principally during the summer months.

In the last year's report of the Committee it was pointed out that there are in the United States about 2000 steam-driven ice plants, which, if operated by central-station power, would mean a consumption of from 600,000,000 to 700,000,000 kilowatt-hours per year. The probabilities are that there will be a steady increase in the number of ice plants. It is the avowed purpose of at least one large ice company to abandon its present ice storage houses as soon as it becomes necessary to replace them with new ones, and this is doubtless the plan of other large companies as well. The artificial ice plant puts the ice business on a more stable basis, making it independent of weather conditions, and, furthermore, makes possible a supply of pure ice. The small lakes from which ice is now being harvested are in constant danger of polution as the population increases around them.

While local conditions will determine just what proportion of existing plants can be supplied with purchased power, there is no question that central-station companies should be able to secure practically all of the new ice plants which will be constructed from now on. There are, at least, two reasons for this.

ADVANTAGES OF THE ELECTRIC PLANT

One of the principal advantages of the electrically operated ice plant is that it may be built at or near the center of the territory to which it is to supply ice, irrespective of railroad facilities. This is a very important point, as it is a well-established fact that a very large item of cost in the ice business is that of delivery to the consumer. The ideal arrangement is to install plants of from 80 to 100-ton capacity about two miles apart, so that each plant will supply the territory within a radius of a mile, thus reducing delivery to a minimum. One other point of advantage is that better ice can be produced, as the trouble frequently encountered in steam-driven plants of having oil carry over from the engine cylinder is entirely eliminated.

In view of these conditions the question is how large a proportion of this business can be secured to the mutual advantage of the central station and the manufacturer. The fact that at the present time most of the ice plants are steam driven should not discourage the central-station men, as it is only recently that this matter has been investigated and gone after by the central station.

FIG. 2. KNICKERBOCKER ICE PLANT, CHICAGO. CAPACITY 120 TONS OF ICE PER DAY

Before proceeding further with this discussion it might be well to point out a few physical facts in connection with the manufacture of ice.

(1) Chemically pure water free from air will freeze solid and clear.

(2) Water containing impurities in solution tends in freezing to force these impurities out of solution. The slower the proc-

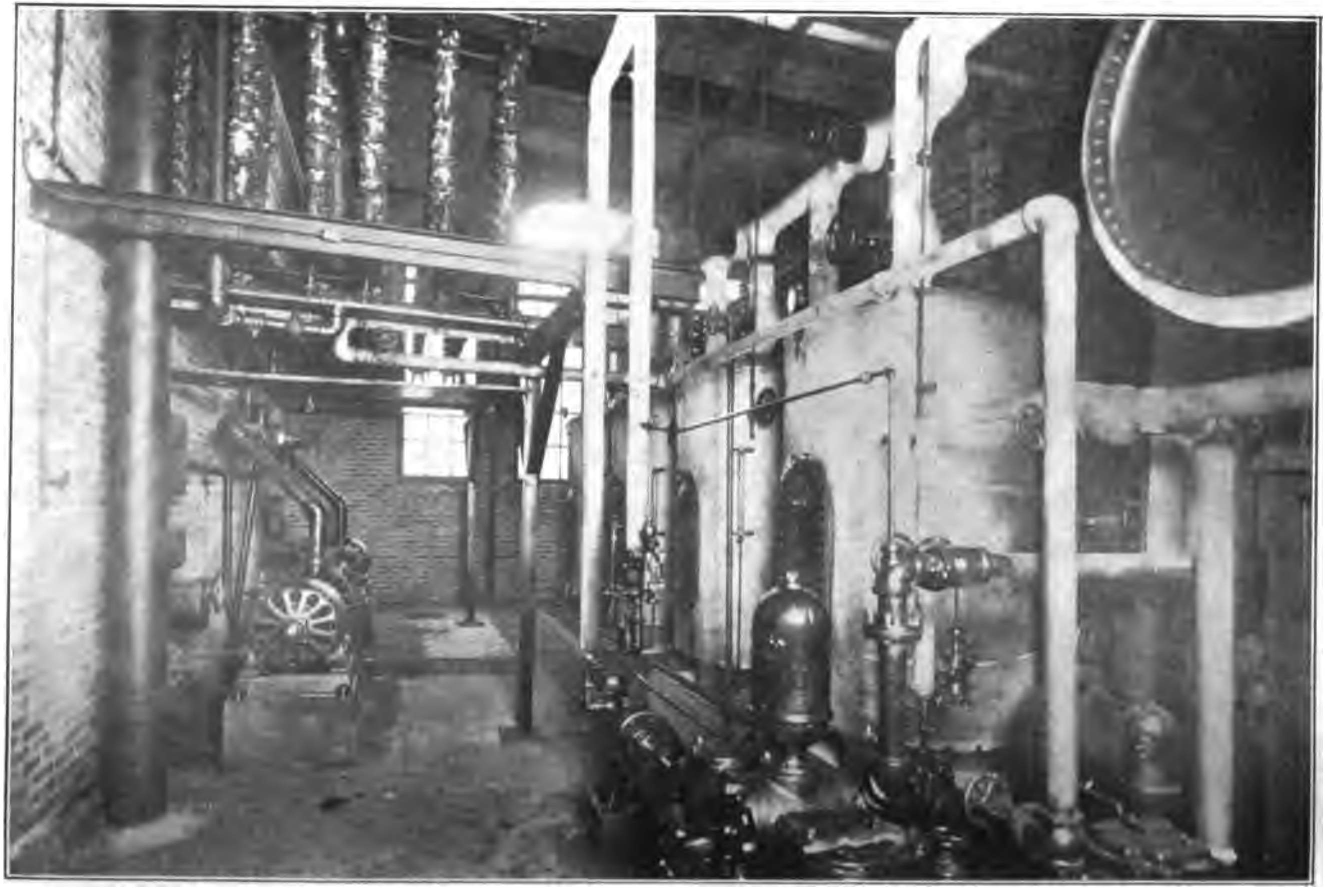


FIG. 3. EVAPORATORS. KNICKERBOCKER ICE CO., CHICAGO.

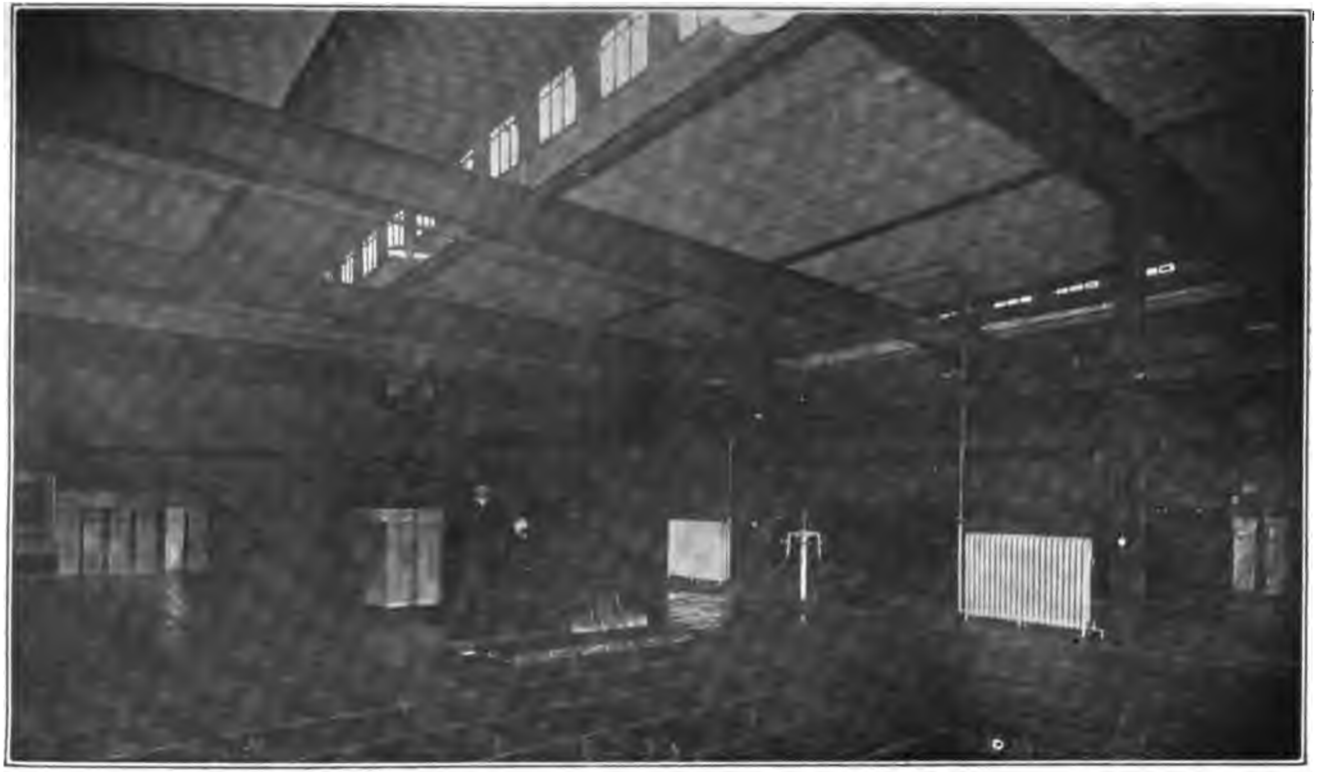


FIG. 4. CAN ROOM. KNICKERBOCKER ICE CO., CHICAGO.

ess of freezing the more completely is the purification effected.

(3) Ice formed in still water sends out long slender crystals, which increase in number and size, forming a meshwork which gradually becomes a solid mass.

(4) Agitation of water during freezing aids in the separation of impurities and is, therefore, of value in the forming of solid clear ice.

FIG. 5. COMPRESSORS. KNICKERBOCKER ICE CO., CHICAGO.

(5) Practically all natural waters contain air and more or less organic or inorganic material in solution. These substances tend to cause the ice formed to be opaque, but as they are frozen out of solution, those that are light rise and collect near the surface, and heavier ones stay near the bottom.

(6) The rate of ice freezing increases as the thickness already formed increases. The time required to freeze increases as the square of the thickness to be frozen. The formation of natural ice is from the top down and impurities frozen

out of solution fall. This and the motion of the water, especially in quiet-running streams, tend to make natural ice transparent. American manufacturers of ice have always tried to duplicate this clearness, although in foreign countries opaque ice is frequently used commercially.

Distilled Water Ice Making

From the foregoing it will be noted that distilled water will freeze solid and practically clear. This is doubtless one of the main reasons why such a large number of plants now in existence are making ice from distilled water. The plan was to utilize the condensed water from the engines for a large part of the distillate. It might be thought by a casual observer that this was an ideal arrangement against which purchased power could not compete. The situation has been met, however, in two ways, (1) by making raw water ice, *i. e.,* freezing the water without first distilling it, and (2) in cases where distilled water ice is desired, by securing the necessary distilled water by means of a multiple effect evaporator. This is an efficient piece of apparatus for securing a very high evaporation of water per pound of coal. With this apparatus six times as much water can be evaporated per pound of coal as with the ordinary boiler. To secure this result, advantage is taken of the fact that water will under vacuum evaporate at a much lower temperature than under ordinary conditions.

Evaporators for ice-plant work are classified broadly into two types—exhaust and high pressure. With the former type we are not directly interested, except that it represents the economy of the steam-driven plant which we must offset with the other advantages of central-station power. In a standard non-condensing steam-driven ice plant the losses vary from 10 to 20 per cent, and hence 100 tons of distilled water in the cans means at least 115 tons produced or handled. Of this amount the compressors and auxiliaries will furnish not over 90 tons, hence a make-up of 20 to 25 tons must be bled from the boilers at the average rate of evaporation of the plant. The exhaust steam evaporator in single effect with an economy of 8 tons of distillate per 10 tons of steam, supplies this make-up with a consequent direct saving in coal represented by this evaporation in the boiler less pump charges. With two effect plants operating from a few pounds above atmosphere to, say, 25 in. of vacuum, the economy may be increased to a ratio of 2¼ to 1 of steam.

If the plant be put upon a standard compound condensing basis a still greater deficiency exists, say 60 per cent of the total

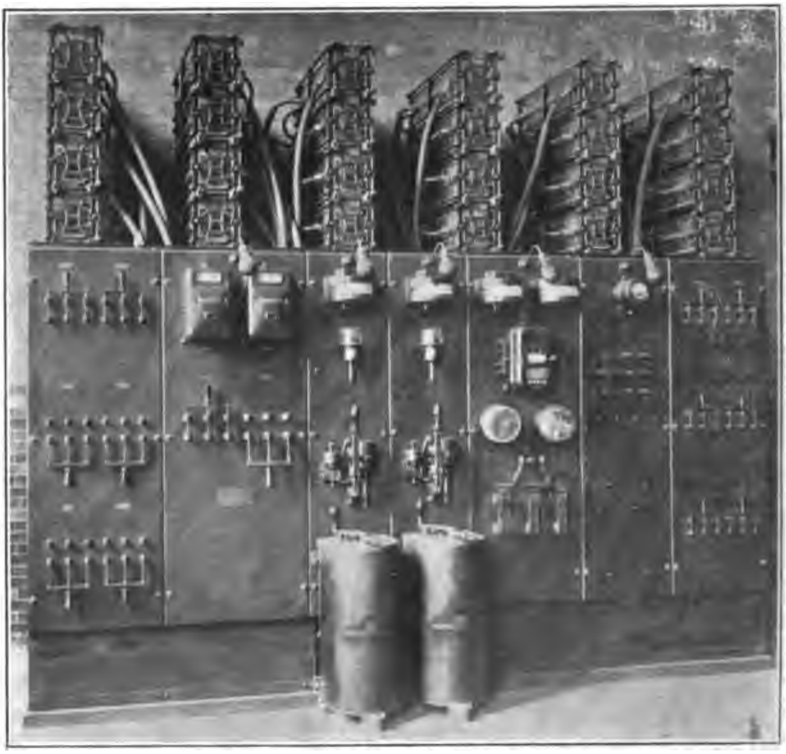


FIG. 6. MAIN SWITCHBOARD. KNICKERBOCKER ICE CO., CHICAGO.

coming from the evaporators, and the cost of production is still more against central-station power. Evaporators for the service may be two or more effects, depending upon the price of coal. Their economy may run to as high as 5½ to 1.

For motor-driven ice plants the problem is merely to produce the distilled water as cheaply as possible, and resolves itself into a consideration of capital investment *versus* efficiency, and the governing factor is usually the price of fuel. With motor-driven pumps, an eight effect plant will give an economy of 6 to 1, and hence produce with average western coal and boiler performance, 45 to 48 tons of distilled water per ton of coal. It is seldom economy to exceed eight effects.

When central-station power is being considered by the ice-plant operator the assumption is justifiable that his fuel cost is at least moderately high. With this premise it is easy to point out to him that in securing the benefits of electric drive he is also gaining something from the operating point, some of the benefits being as follows:

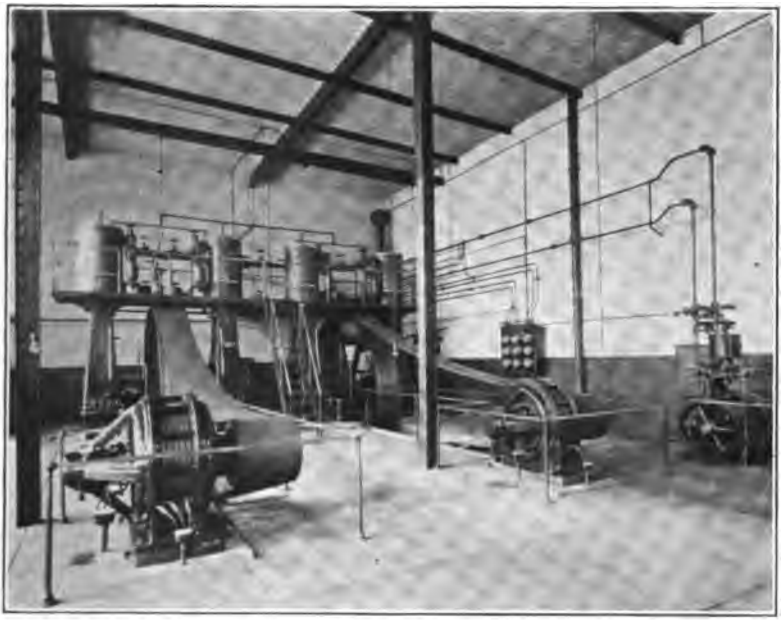


Fig. 7. Engine Room Showing Motor Drive. Webster Citizens Co., Buffalo.

(1) He can secure an absolutely oil and air-free distilled water by use of the evaporators.

(2) His cost to produce this water is very low per ton of ice made.

(3) His investment may be so proportioned to his fuel cost that the cost to produce the distilled water will be a minimum under all conditions.

(4) His boiler plant is reduced to approximately one-sixth of the capacity required with a steam-driven plant.

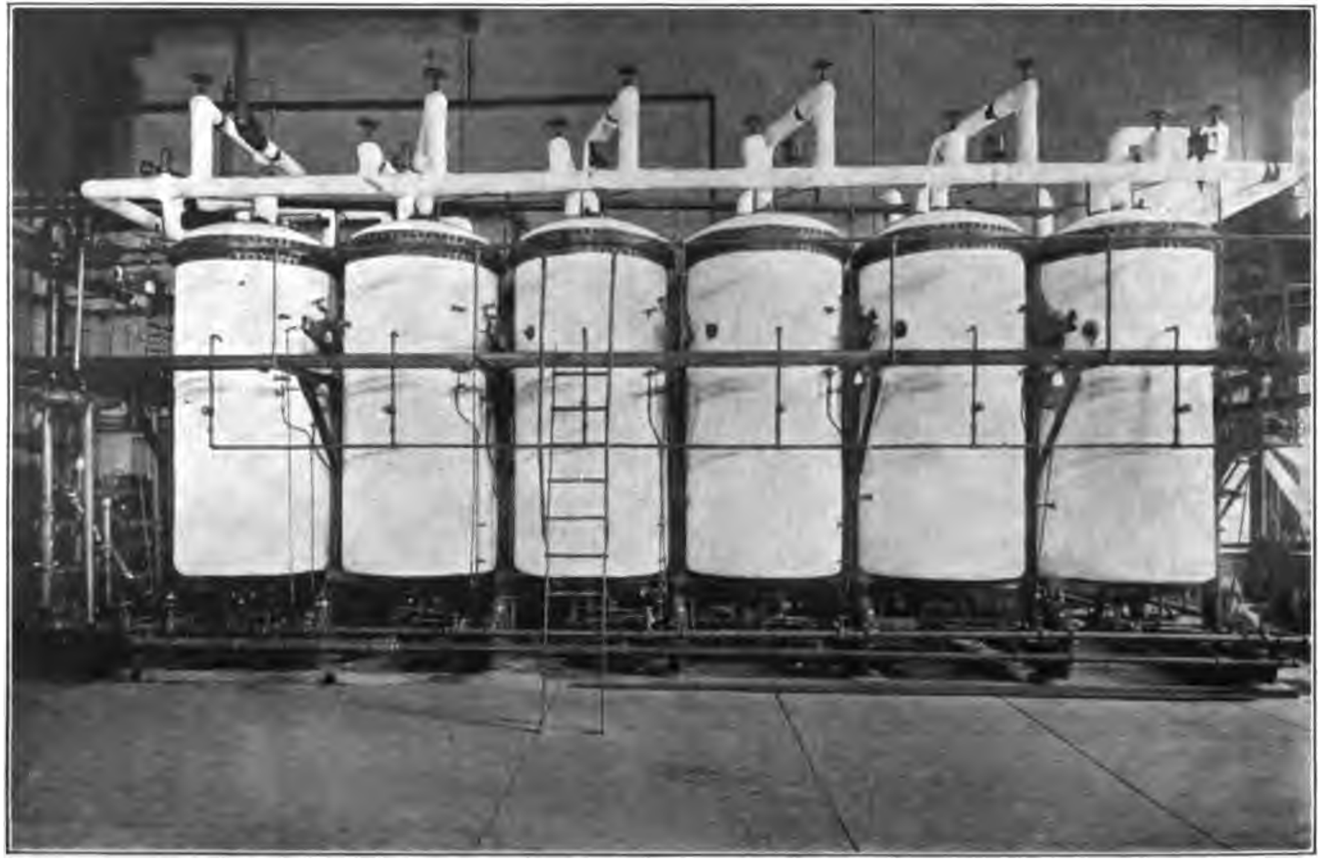


FIG. 8. MULTIPLE EFFECT DISTILLING EQUIPMENT. WEBSTER CITIZENS CO., BUFFALO, N. Y.

(5) The amount of condensing water required for his steam condenser is likewise reduced, it being necessary only to condense the vapor from the last effect, for the reason that each evaporator forms the condenser for the previous effect.

(6) The system of heat exchangers employed permits the boiler feed as well as the evaporator feed to be heated to a high temperature which conduces to high economy.

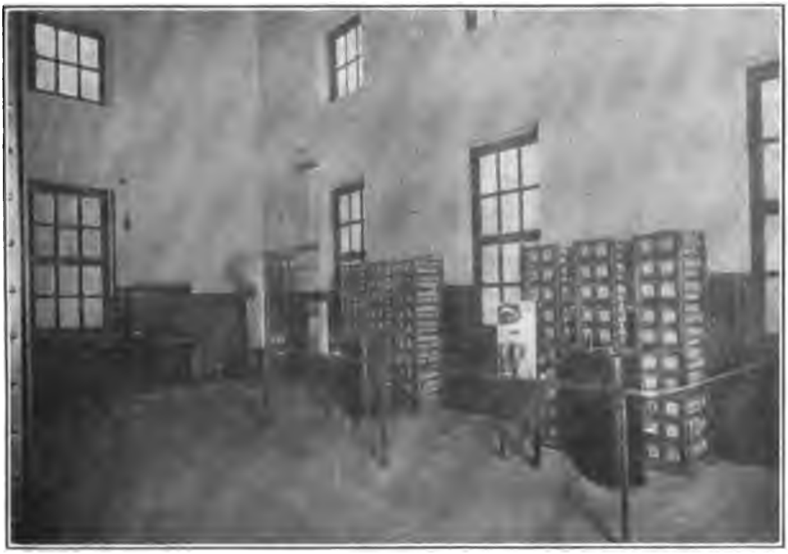


FIG. 9. MOTOR RESISTANCE CONTROL. WEBSTER CITIZENS CO., BUFFALO, N. Y.

(7) The modern evaporator construction enables the operator to clean the evaporator with less trouble than the average boiler can be cleaned.

(8) The amount of distilled water produced and hence of coal burned may vary with his requirements, whereas, in a steam plant his production of distilled water remains almost constant.

(9) The only water losses in a motor-driven plant are filling losses which are the smallest water losses in the plant.

In distilling equipment of this kind it is essential that all piping be tinned on the inside so as to prevent the distilled water from attacking iron and thus discoloring the water.

Raw Water Plants

In order to do away with the necessity of using distilled water many raw water plants have been built and are giving very good results. It is the recommendation of your Committee that under ordinary conditions this is the proper type of plant to advocate, although there seems to be a difference of opinion among ice manufacturers on this subject. Probably local conditions will be the determining factor.

One of the items which must have an important bearing will be the character of the water supply. In some sections of the country where the water contains a large amount of mineral substance in solution, it may be difficult to secure clear raw water ice, but ordinarily there is very little difference in the appearance of distilled water ice and raw water ice as manufactured in the best plants.

Methods of Manufacture

The methods of manufacture of raw water ice can be classed under two general heads—the first known as the Can System and the second as the Plate System. Practically all of the plants now in operation are of the can type, although there are a few of the plate variety.

Can Plants

In a can plant the ice is formed in large cans in which filtered raw water has been placed, these cans being immersed in tanks of refrigerated brine which is being constantly circulated by means of pumps. During the process of freezing the water in the cans is agitated by means of compressed air, which agitation is necessary in order to secure clear ice, as previously explained. The water in the cans is permitted to freeze until the core is reached, at which time the core water is replaced by distilled water and the cake frozen solid, leaving simply a feathery effect through the middle of the cake. This removal of the raw water from the core is necessary in order to secure a clear cake of ice, as, of course, it would be impossible to agitate the raw water until it is entirely frozen. Then, too, the water which has been removed from the core contains practically all of the impurities from the entire can. This process involves the use of between 15 and 20 per cent of distilled water which can be supplied by means of a small multiple effect evaporator, such as is used in regular distilled-water plants.

Plate Plants

In the plate type of plant hollow plates through which cold brine or ammonia can be made to circulate, are immersed vertically in tanks filled with water which is agitated. The ice forms gradually on both sides of the plates, thus ridding itself of any air or other impurities on its surface. In the can system these impurities concentrate toward the center, forming an impure core which is removed as previously explained. With the plate system it is not necessary to distill or boil water which is otherwise pure for ice making. The plate plant, however, requires more skill to manipulate it successfully, and is more expensive to install and keep in repair.

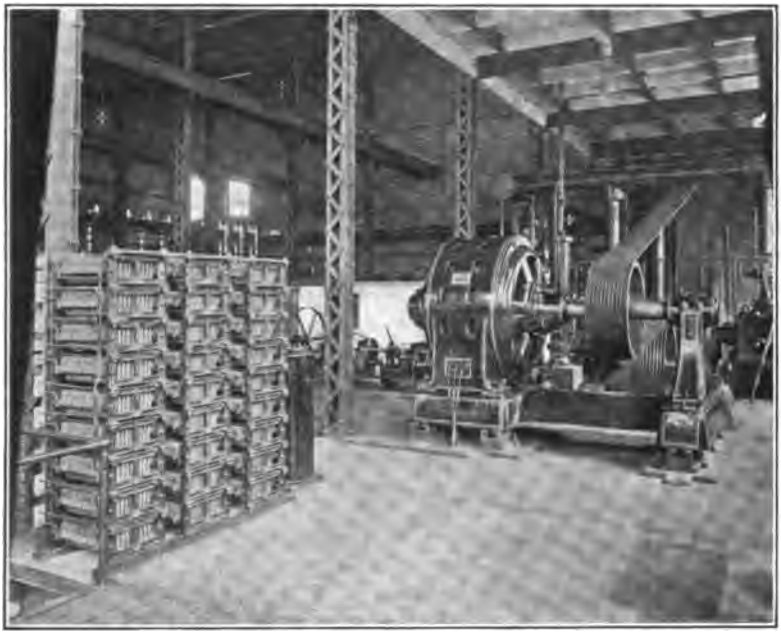


FIG. 10. COMPRESSOR ROOM PLATE PLANT. CRYSTAL ICE & STORAGE CO., BUFFALO, N. Y.

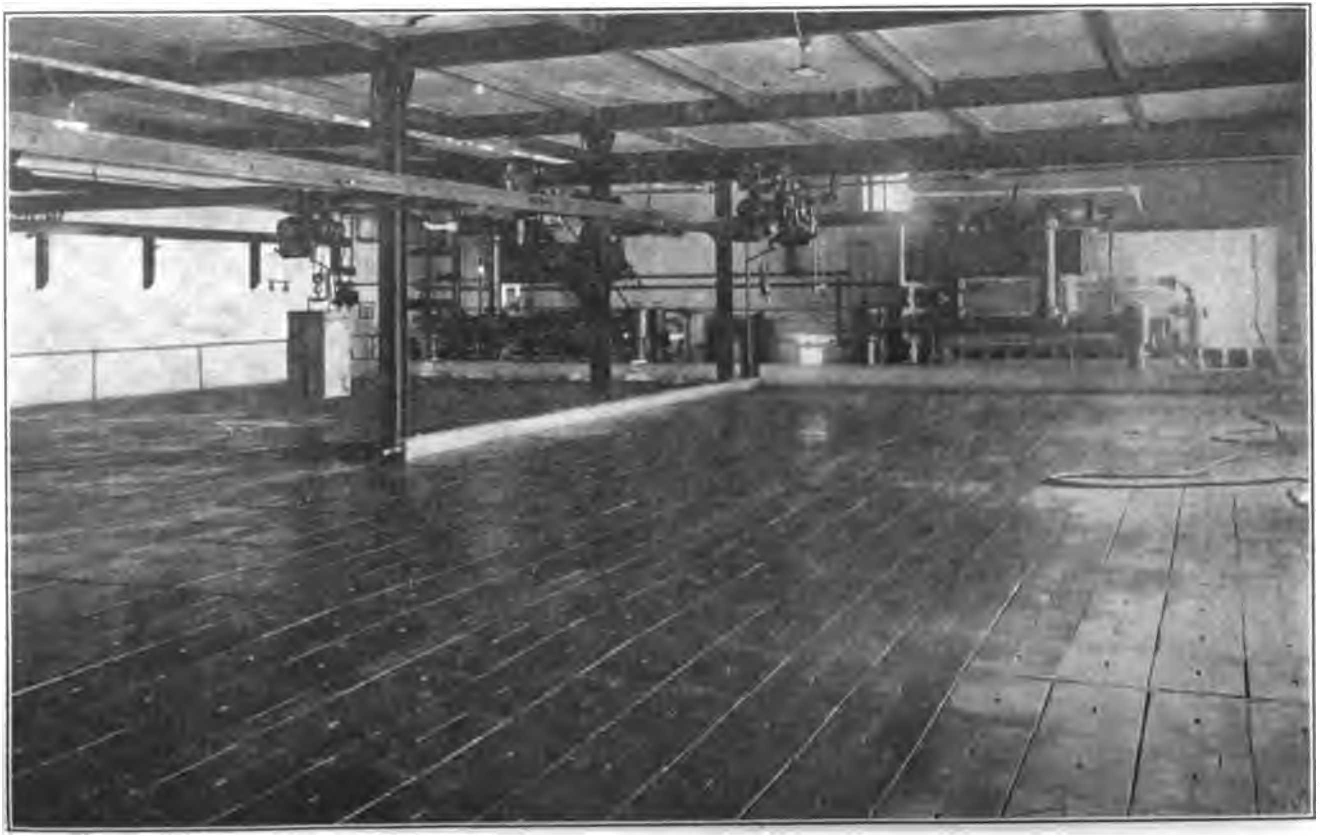


FIG. 11. TANK ROOM PLANT. WEBSTER CITIZENS CO., BUFFALO, N. Y.

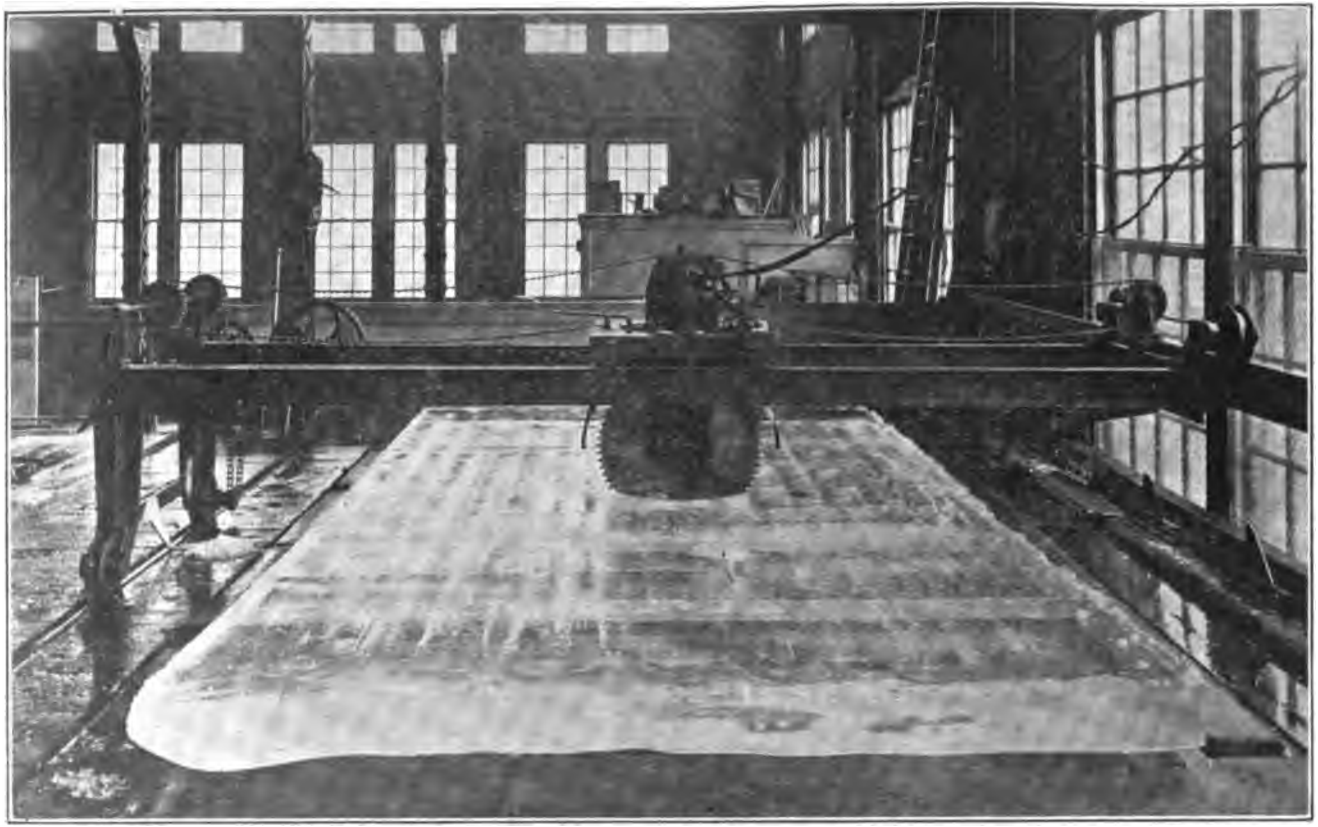


FIG. 12. PLATE PLANT. CRYSTAL ICE & STORAGE CO., BUFFALO, N. Y.

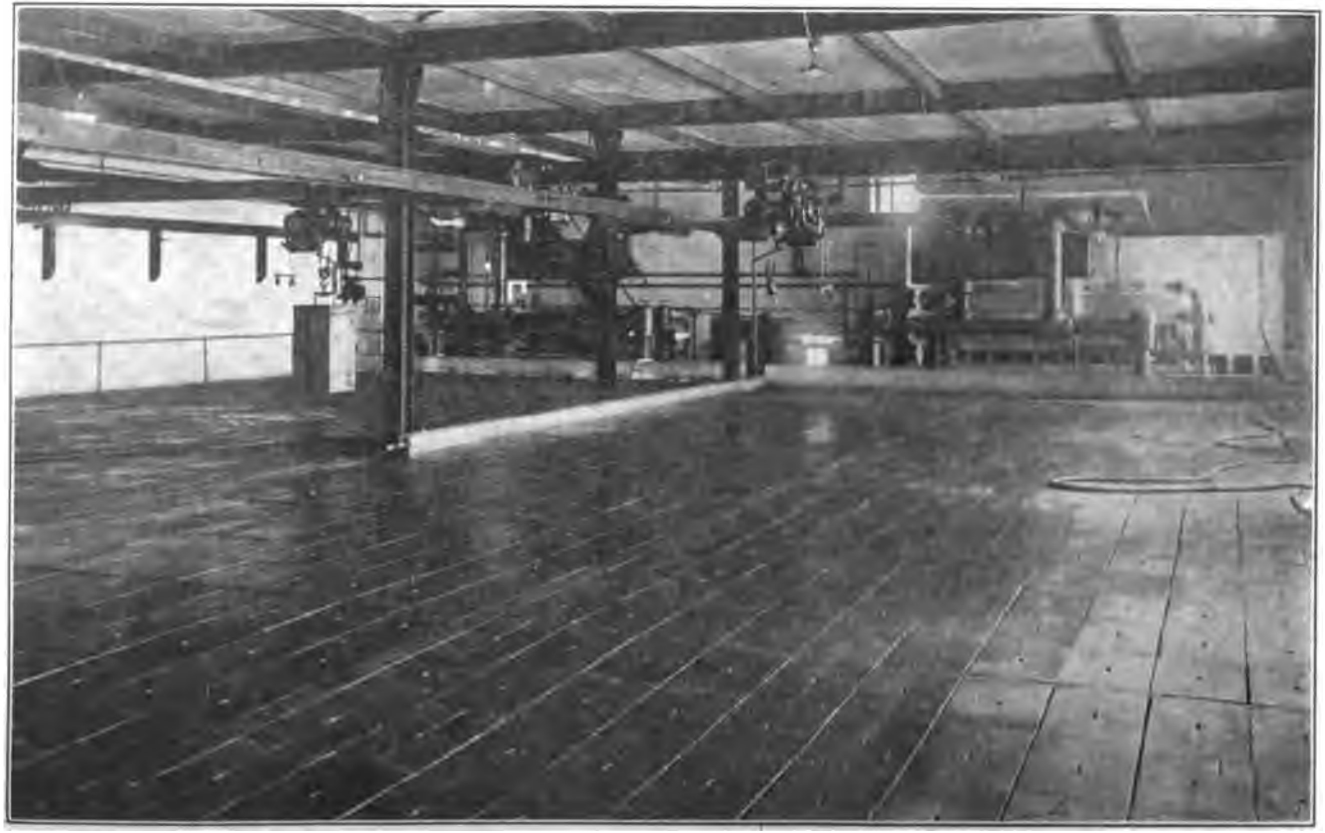


FIG. 11. TANK ROOM PLANT. WEBSTER CITIZENS CO., BUFFALO, N. Y.

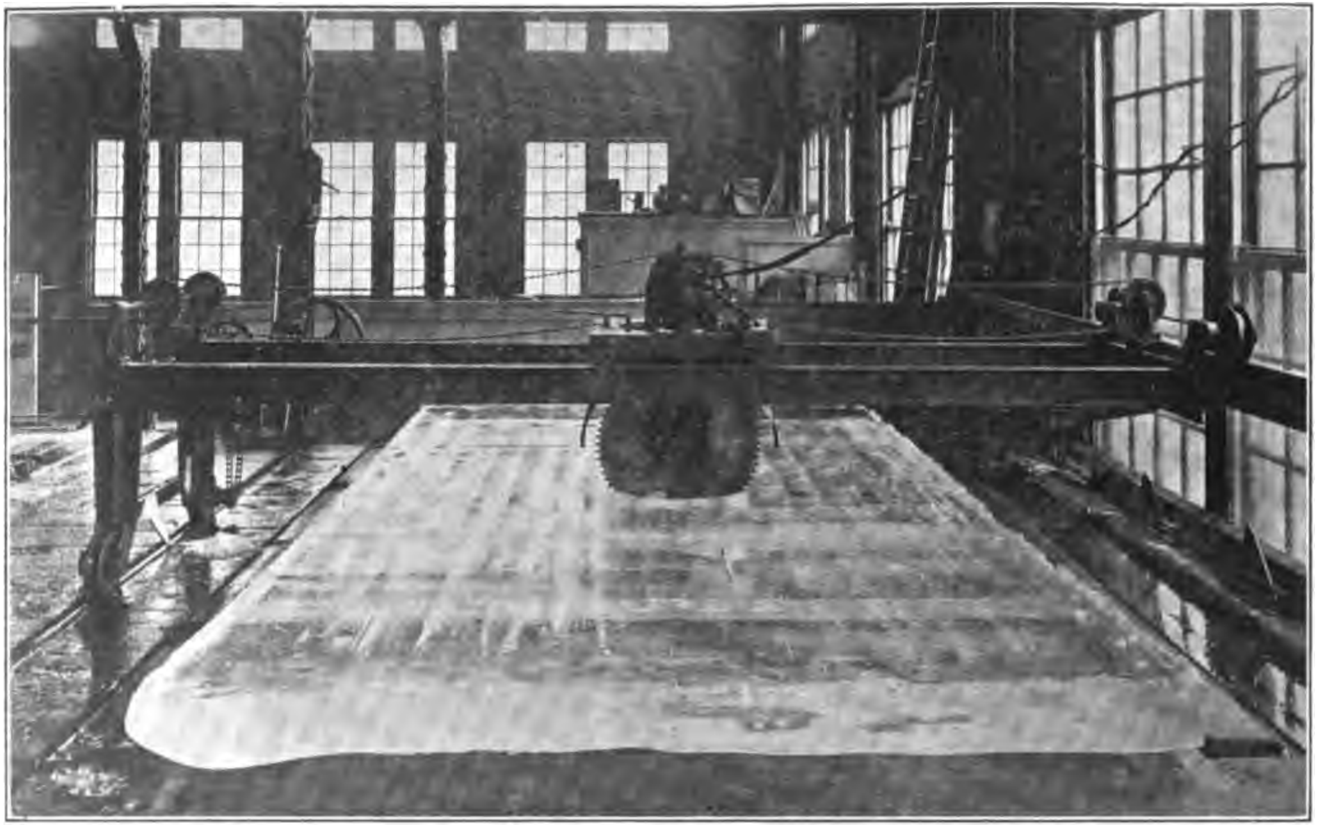


FIG. 12. PLATE PLANT. CRYSTAL ICE & STORAGE CO., BUFFALO, N. Y.

In this system when the ice is formed to the desired thickness (usually about 12 in.), it is loosened from the freezing plates by various thawing arrangements. The ice cakes, often 9 ft. x 16 ft. x 12 in. in thickness, are lifted from the tanks by overhead cranes, and are carried to a table where they are cut to commercial size.

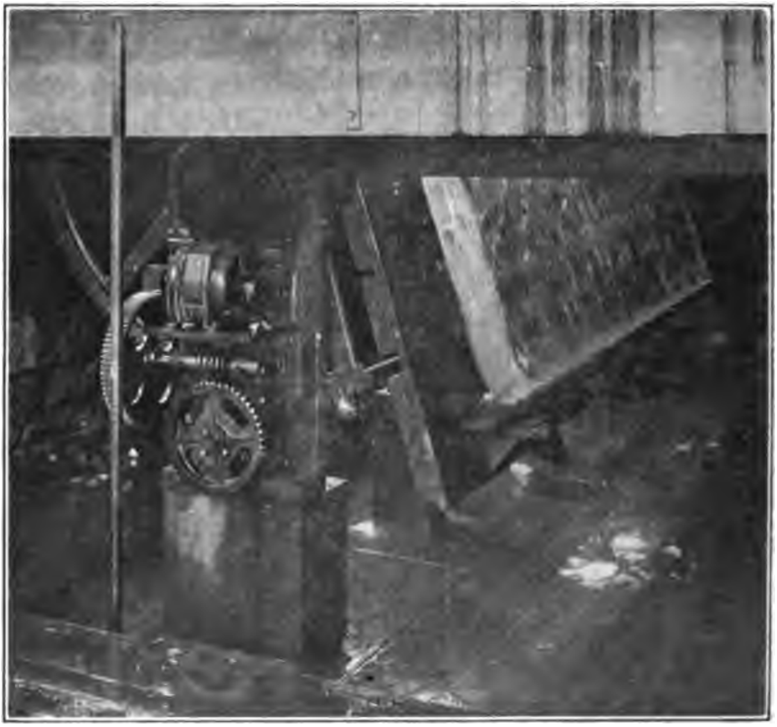


FIG. 13. PLATE PLANT (MECHANISM OF TIPPING TABLE). CRYSTAL ICE & STORAGE CO., BUFFALO, N. Y.

Motor Drive

In order that the successful operation of an electrically driven ice plant may be assured, it is necessary that a proper equipment be installed. One of the important features is the type of motor to be used. In all probability the great majority of the plants to be considered will be located in territory in which the central-station supply is alternating current; in fact, all of the large plants thus far constructed have been equipped with 3-phase motors.

There is some difference of opinion as to whether motors should be designed for constant speed or variable speed. In any event, they should be of the slow-speed, slip-ring induction type, and equipped with drum controllers. In case constant speed work is desired, the resistance to be furnished with the controller need be large enough simply for starting the motor. If at a later time it becomes desirable to operate the motor at variable speed, the only change required will be to install additional resistance. The use of multi-speed motors has been suggested for this class of work, but it is the opinion of your Committee that this practise should be discouraged, as the efficiency of the motor at full load is not quite as high as the standard motor, and, furthermore, the power factor is considerably lower.

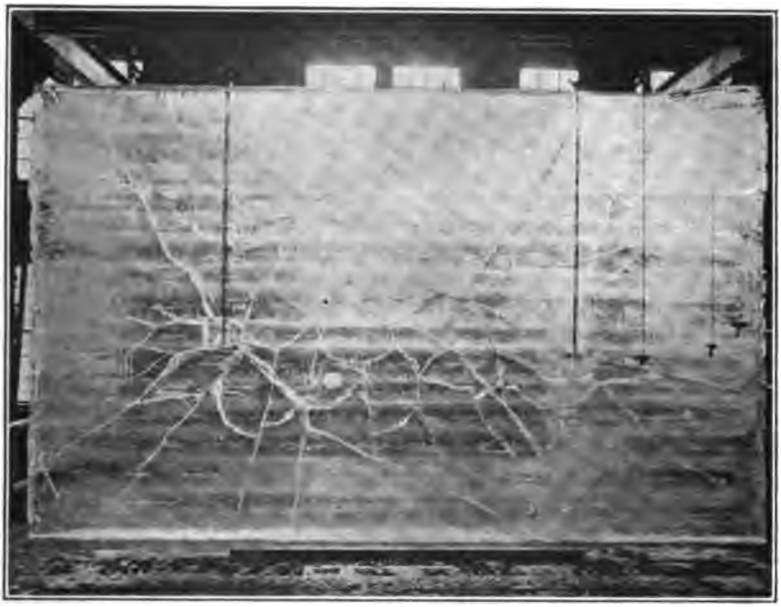


FIG. 14. ICE PLATE IN SUSPENSION OVER TANKS, WEIGHT 4 TONS, REQUIRING SIX DAYS TO FREEZE. CRYSTAL ICE & STORAGE CO., BUFFALO, N. Y.

Voltage of Motor

While some of the companies have adhered to the standard practise of using 220-volt motors, others have adopted the plan of operating the large compressor motors at primary voltage of approximately 2300 volts, using lower voltage on motors operating the auxiliaries. The efficiencies of 3-phase motors are the same at either 230 volts or 2300 volts. The factors involved in making a choice are the economies in operation due to the elimination of transformer losses, and the comparative costs of first installation. The use of primary voltage on motors, however, introduces a risk to attendants which many of the large companies hesitate to assume.

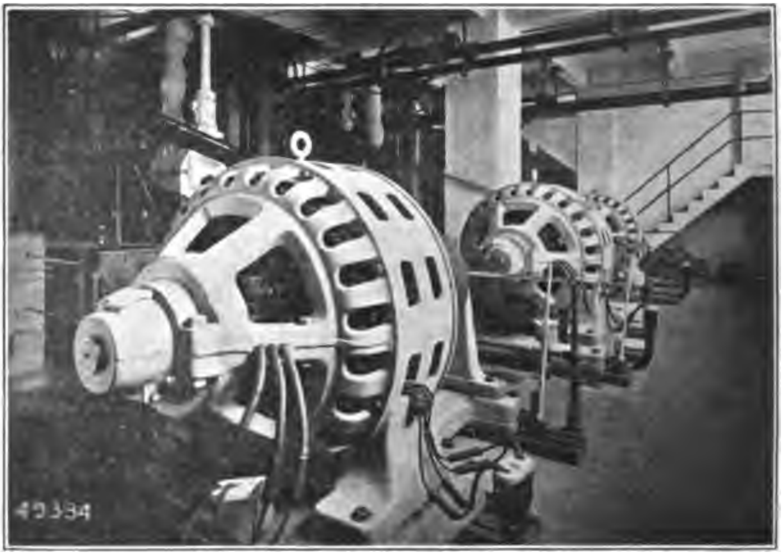


FIG. 15. VIEW SHOWING SLIP-RING ENDS OF THREE 125-HP. PHASE-WOUND, EXTERNAL RESISTANCE TYPE OF WESTINGHOUSE MOTORS, EACH DRIVING A 165-TON WOLFE LINDE ICE MACHINE CO. COMPRESSOR. SEATTLE, WASH.

Comparative Operating—Steam and Electric

The question is often asked whether or not an electrically operated plant can be made to operate as cheaply as a steam driven plant when the location is favorable to the steam plant, that is, when ample railroad facilities are available so that coal can be brought in under the best conditions. This question is best answered in the words of one of the largest ice operators in the country, who has a number of distilled-water ice plants, both steam and electric. He states that under his conditions of operation there is practically no difference in the cost of manufacture under the two systems. Under the electric plan of operation, however, he can locate plants to best suit his needs, and, furthermore, the possibility of contamination from oil is removed, which is a point of value.

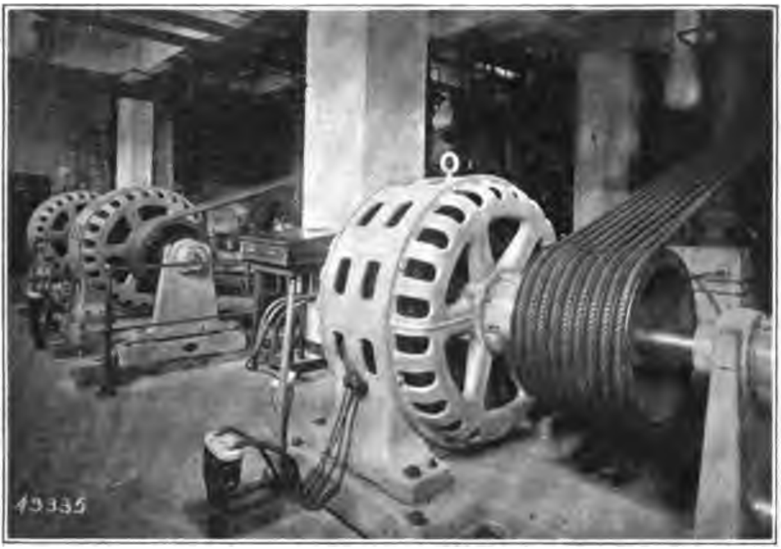


FIG. 16. PULLEY END OF SAME MOTORS, SHOWING ROPE DRIVE

Ice Plant Data

Operating data on typical electrically driven ice plants will be found in Appendix D.

CONCLUSION

Your Committee is of the unanimous opinion that the refrigeration and ice business can well be given the most careful thought and attention by central-station companies in every part of the country and hopes that the information given in this report will assist them in securing a large measure of this business. It wishes also to take this opportunity of thanking those in the various organizations who have so cheerfully contributed to the securing and compiling of data for this report.

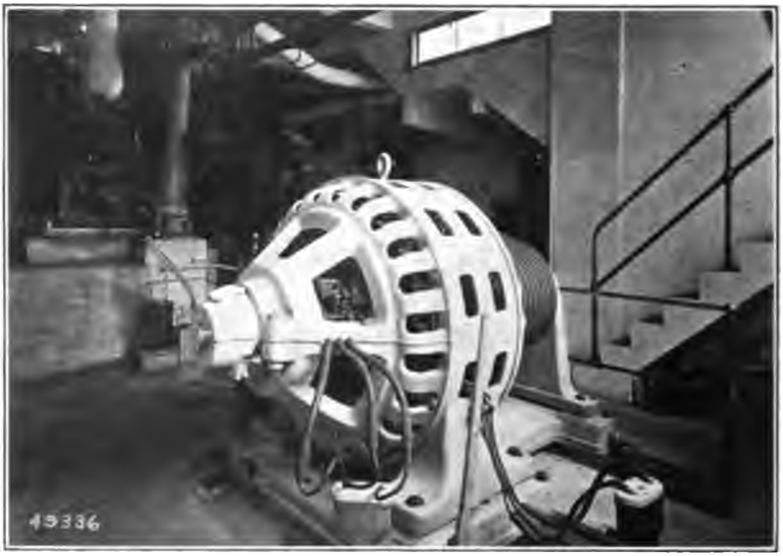


FIG. 17. 125-HP. 2-PHASE, 60-CYCLE, 220-VOLT, SLIP-RING TYPE OF MOTOR, WESTINGHOUSE TYPE HF. CONNECTED BY ROPE DRIVE TO A 65-TON WOLFE LINDE AMMONIA COMPRESSOR. DIAMOND ICE CO., SEATTLE, WASH.

Respectfully submitted,

Committee
Geo. H. Jones, ***Chairman***
W. E. Clement
S. A. Fletcher
R. L. Lloyd
C. K. Nichols
H. P. Pitts
J. W. Perry
A. C. Smith
R. H. Tillman

APPENDIX A

LIST OF REFERENCE BOOKS ON REFRIGERATION

Anderson—Refrigeration	$2.25	net
Audel—Answers on Refrigeration and Ice Making (2 vols.)	4.00	"
Ewing—Mechanical Production of Cold	3.25	"
Leask—Refrigerating Machinery	2.00	"
Lorenz—Modern Refrigerating Machinery	4.00	"
Redwood—Theoretical and Practical Refrigeration	1.00	"
Wallis-Taylor—Pocketbook of Refrigeration	1.50	"
" " Refrigerating and Ice-Making Machinery	3.00	"
" " Refrigeration, Cold Storage and Ice Making	4.50	"
Matthews—Elementary Mechanical Refrigeration	2.00	"
Williams & Tweedy—Commercial Engineering for Central Stations	2.50	"
Dr. Hans Lorenz, Trans. Dean and Haven—Modern Refrigerating Machinery		
J. S. Siebel—Compend. of Mechanical Refrigeration		
Madison Cooper—Modern Cold Storage		
John Levey—Refrigeration Memoranda		

APPENDIX B

PARTIAL LIST OF MANUFACTURERS OF REFRIGERATING APPARATUS:

American Machine Co., Louisville, Ky.
Arctic Ice Machine Co., Canton, Ohio.
Armstrong Machinery Co., Spokane, Wash.
Automatic Refrigerating Co., Hartford, Conn.
Baker Ice Machine Co., Omaha, Neb.
Brunswick Refrigerating Co., New Brunswick, N. J.
Buffalo Refrigerating Machine Co., New York.
Carbondale Machine Co., Carbondale, Pa.
Cleveland Ice Machine Co., Cleveland, Ohio.
Columbus Iron Works, Columbus, Ga.
Creamery Package Mfg. Co., De Kalb, Ills.
De La Vergne Machine Co., New York City.
Frick Co., Waynesboro, Pa.

Great Lakes Engineering Works, Detroit, Mich.
Huetteman & Kramer Co., Detroit, Mich.
Ice and Cold Machine Co., St. Louis, Mo.
Isbell-Porter Co., Newark, N. J.
H. W. Johns-Manville Co., New York, N. Y.
Kent Co., Ltd., Montreal, Quebec, Canada.
Kroeschell Bros. Ice Machine Co., Chicago, Ills.
Larsen Ice Machine Co., Chicago, Ills.
MacDonald, Ltd., C. A., New York City.
Mayer Ice Machine and Engineering Co., Jersey City, N. J.
Maynard, J. F., St. Louis, Mo.
Mechanical Refrigerating Co., Philadelphia, Pa.
Phœnix Ice Machine Co., Cleveland, Ohio.
Polar Ice Machine Co., Chicago, Ills.
Railway Stationary Refrigerating Co., 11 Pine St., New York.
Rebsamen & Almeroth, Chicago, Ills.
Remington Machine Co., Wilmington, Del.
Roelker, H. B., New York City.
Roemmeli-Dawley Manufacturing Co., St. Louis, Mo.
Schantz Co., The, New York City.
Triumph Ice Co., Cincinnati, Ohio.
United Refrigerator Ice Machine Co., The, Kenosha, Wis.
United Iron Works Co., Springfield, Mo.
Vilter Manufacturing Co., Milwaukee, Wis.
Vogt, Henry, Machine Co., Louisville, Ky.
Vulcan Iron Works, San Francisco, Cal.
Wegner Machine Co., Buffalo, N. Y.
Wisconsin Ice Machine Co., Chicago, Ill.
Wolf, Fred W., Co., Chicago, Ill.
York Manufacturing Co., York, Pa.

APPENDIX C

TABULATED DATA ON REFRIGERATING INSTALLATIONS

PIPE COVERING

FOR BRINE			SIZE OF PIPE — INCHES	FOR DRINKING WATER		
Ice Water Cover				Cold Water Cover		
Outside Diameter of Cover—Inches	Transmission in B.t.u. per lineal foot in 24 hr. for a Temp. Diff. of 70°F.	Saving Over Bare Pipe in B.t.u. per lineal foot per 24 hr. for a Temp. Diff. of 70°F.		Outside Diameter of Cover—Inches	Transmission in B.t.u. per lineal foot in 24 hr. for a Temp. Diff. of 40°F.	Saving Over Bare Pipe in B.t.u. per lineal foot per 24 hr. for a Temp. Diff. of 40°F.
3.25	269	396	½	2.62	230	150
3.75	280	551	¾	3.25	240	235
4.25	298	738	1	3.25	256	337
4.62	335	980	1¼	3.75	287	463
4.75	369	1135	1½	4.00	319	540
5.31	412	1465	2	4.62	353	720
6.62	511	2270	3	5.62	438	1145

Divide the B.t.u. saved by 144 to get saving in pounds of ice as refrigeration.

EXAMPLE

The saving for ½ in. brine pipe with ice water covering would be 396/144 pounds of ice as refrigeration, per lineal ft. per 24 hr.

REFRIGERATION DATA

OFFICE BUILDINGS

Name	City	Kw-hr. per year	Average Max-imum	Hp. Con-nected	Tons Refrig-erating	Kw-hr. per year per Ton	Kw-hr. per year per Hp.	Refrigerating Equipment and Requirement
Philadelphia Electric Co.	Philadelphia, Pa.	3451		6	2	1725	575	See Note No. 1
National Park Bank	New York, N. Y.	17235		16	10	1723	1077	" " " 2
New York Edison Co.	" " "	8062		10	5	1614	807	" " " 3
New York Telephone Co.	" " "	14875		10	5	2976	1488	" " " 4
WHOLESALE MEAT MARKETS								
Swift & Co.	Philadelphia, Pa.	25728		15	8	3216	1715	" " " 5
Swarzschild & Sulzberger	" "	76068		35	18	4226	2173	" " " 6
Swarzschild & Sulzberger	" "	30448		10	6	5074	3044	" " " 7
Armour & Co.	" "	42636		25	15	2820	1704	" " " 8
Swarzschild & Sulzberger	New York, N. Y.	28030		25	10	2800	1120	" " " 9
Withheld	Providence, R. I.	26140		25	12	2178	1044	" " " 10
Withheld	" "	62980		35	20	3142	1798	" " " 11
A. Booth & Co.	Chicago, Ill.	30456		30	12½	2420	1015	" " " 12
Lake Superior Fish Co.	" "	14880		10	7	2126	1488	" " " 13
Withheld	Pittsburgh, Pa.	159250		50	20	7962	3185	" " " 14

1. The refrigeration equipment consists of:

1—5-hp. Northern motor, variable speed, d-c., 220 volt, belted to—
  1—2-ton Larson-Baker compressor. This cools drinking water for eight outlets.

2. The refrigeration equipment consists of:

1—16-hp. Triumph motor, belted to—
  1—10-ton Triumph compressor. This cools water for ten outlets.

3. The refrigeration equipment consists of:

1—10-ton hp. motor, belted to—
  1—5-ton York compressor. This cools drinking water for the building.

4. The refrigeration equipment consists of:

1—10-ton hp. motor, belted to—
  1—5-ton Voss compressor. This cools drinking water for the building.

5. The refrigeration equipment consists of:

1—15-hp. Allis-Chalmers motor, d-c., 220 volt, 700 r.p.m., belted to—
  1—Huetteman & Cramer compressor 7 in. by 14 in. This cools by direct expansion three boxes on two floors, totalling 22,980 cu. ft.

6. The refrigeration equipment consists of:

1—35-hp. G. E. motor, type M, 2-phase, 220 volt, 1200 r.p.m., belted through countershaft to—
  1—18-ton Automatic compressor. This cools by direct expansion three large ice boxes.

7. The refrigeration equipment consists of:

1—10-hp. Westinghouse d-c. motor, 220 volt, 650 r.p.m., belted to—
  1—6-ton Automatic compressor. This cools by direct expansion one cooler, capacity 15,732 cu. ft.

8. The refrigeration equipment consists of:

1—25-hp. Crocker-Wheeler motor, d-c., 220 volt, 750 r.p.m., belted through countershaft to—
  1—15-ton Automatic compressor. This cools by direct expansion two boxes, totalling 21,384 cu. ft.

9. The refrigeration equipment consists of:

1—25-hp. motor, belted to—
  1—10-ton Automatic compressor. This cools by direct expansion one cooler, 44,250 cu. ft., to 15 deg. fahr., and another cooler, 44,250 cu. ft., to 15 deg. fahr.

10. The refrigeration equipment consists of:

1—25-hp. motor, belted to—
  1—12-ton Compressor. This operates 7 hours per day. Box holds 150 tons when full, but will average about 50 tons.

11. The refrigeration equipment consists of:

1—35-hp. motor, belted to—
  1—20-ton Compressor. This operates 18 hours in summer and 5 hours in winter. Ice box holds 30 tons of meat.

12. The refrigeration equipment consists of:

1—30-hp., 220 volt, 1250 r.p.m., d-c., Hawthorne motor, belted to—
  1—12½-ton Larson-Baker compressor.

The refrigerating requirements consist of:
  1—Room for fish, 28 ft. by 18 ft. by 7½ ft., 18 deg.,
  1—Room for ice, 28 ft. by 14 ft. by 7½ ft., 22 deg.,
  1—Room for fish, 28 ft. by 15 ft. by 10 ft., 18 deg.,
  1—Room for fish, 30 ft. by 15 ft. by 10 ft., 16 deg.,
  1—Morgue for fresh fish, 30 ft. by 27 ft. by 7 ft., 32 deg.,
  1—Room for fish, 14 ft. by 15 ft. by 10 ft., 16 deg.

13. The refrigeration equipment consists of:

1—10-hp., 800 r.p.m., 220 volt, d-c., Roth motor, belted to—
  1—7-ton Creamery Package Manufacturing Co. compressor.

The refrigeration requirements consists of:

1—Room for fish, 30 ft. by 17½ by 10 ft., 20 deg.
1—Room for fish, 10 ft. by 17½ ft. by 7 ft., 18 deg.,
1—Room for fish, 10 ft. by 17½ ft. by 7 ft., 18 deg.,

14. The refrigeration equipment consists of:

1—50-hp. Westinghouse motor, 3-phase, 220 volt, 850 r.p.m., belted to—
  1—20-ton Wolf compressor. This cools one storage room containing 94,000 cu. ft. to 30 deg. fahr.

REFRIGERATION DATA

PROVISIONS

Name	City	Kw-hr. per year	Average Max-imum	Hp. Con-nected	Tons Refrig-erating	Kw-hr. per year per Ton	Kw-hr. per year per Hp.	Refrigerating Equipment and Requirement
S. Ershowsky	New York, N. Y.	23412		15	8	2930	1560	See Note No. 1
P. Ohl	New York, N. Y.	10503		7½	4	2626	1400	" " " 2
John J. Felon & Co.	New York, N. Y.	25783		10	4	6446	2578	" " " 3
C. Sehnek & Co.	New York, N. Y.	5613		5	2	2807	1123	" " " 4
Fischer & Co.	New York, N. Y.	34610		15	5	6930	2310	" " " 5
George S. Sloan	Chicago, Ill.	10620	7	10	6	1770	1062	" " " 6
George Middendorf & Co.	Chicago, Ill.	12204	9	15	8	1533	816	" " " 7
Bennet & Co.	New Orleans, La.	3828	4	7½	5	766	512	" " " 8
L. Frank Co.	New Orleans, La.	14772	6	10	4	3693	1477	" " " 9

1. The refrigeration equipment consists of:
1—15-hp. motor, connected to—
  1—8-ton Voss ice machine.
  To cool a space of 10,505 cu. ft. to 36 deg.

2. The refrigeration equipment consists of:
1—7½-hp. motor, connected to—
  1—Machine making 4 tons.
  To cool one box of 504 cu. ft. to 26 deg., one of 400 cu. ft. to 32 deg., and one of 1100 cu. ft. to 38 deg.

3. The refrigeration equipment consists of:
1—10-hp. motor, connected to—
  1—Victor Machine Co. compressor, 4 tons capacity. To cool a space of 38,880 cu. ft. to 38 deg.

4. The refrigeration equipment consists of:
1—5-hp. motor, connected to—
  1—2-ton Automatic Refrigerating Machine Co. To cool a space of 216 cu. ft. to 34 deg. and another space of 288 cu. ft. to 20 deg.

5. The refrigeration equipment consists of:
1—15-hp. motor, connected to—
  1—5-ton Voss Machine Co. machine. There is also a meat chopper of 20 hp. on this consumption. To cool a space of 5060 cu. ft. to a temperature of from 38 to 44 deg.

6. The refrigeration equipment consists of:
1—10-hp., G. E., 1375 r.p.m. motor, 220 volt, d-c., belted to—
  1—6-ton Barber compressor.
  To cool one room for fish and poultry, size 18 ft. by 18 ft. by 8 ft., to 20 deg.

7. The refrigeration equipment consists of:
1—15-ton Northern motor, 725 r.p.m., 220 volt, d-c., belted to—
  1—8-ton A. H. Baker compressor.
  To cool one box for fruit, size 12 ft. by 36 ft. by 8 ft., to 39 deg., and one box for butter, size 24 ft. by 28 ft. by 8 ft., to 42 deg.

8. The refrigeration equipment consists of:
1—7½-hp. Detroit motor, operating—
  1—5-ton Smith-Vale compressor. To furnish refrigeration for a box 12 ft. by 16 ft. and one box 10 ft. by 12 ft. by 10 ft.

9. The refrigeration equipment consists of:
1—10-hp. Allis-Chalmers motor, constant speed, belted to—
  1—4-ton Refrigerating machine (single acting). This machine runs 10 hours per day using direct expansion system.

REFRIGERATION DATA

Name	City	Kw-hr. per year	Average Max-imum	Hp. Con-nected	Tons Refrig-erating	Kw-hr. per year per Ton	Kw-hr. per year per Hp.	Refrigerating Equipment and Requirement
RESIDENCES								
Convent of J. & M.	New York, N. Y.	15606		8	6	2601	1600	See Note No. 1
M. Eisenlohr	Philadelphia, Pa.	984		1	¼	3776	984	" " " 2
J. S. Bancroft	Philadelphia, Pa.	822		1½	¼	3288	548	" " " 3
APARTMENTS								
Thomas A. R. Hall	New York, N. Y.	16486		10	5	3300	1650	" " " 4
Wyneva Apartments	Philadelphia, Pa.	10044		7½	4	2511	1334	" " " 5
HOSPITALS								
Jefferson Hospital	Philadelphia, Pa.	125139		70	20	6256	1787	" " " 6
BEER STORAGE								
Ballantine & Sons	New York, N. Y.	20691		31½	12	1724	667	" " " 7

1. The refrigeration equipment consists of:
1—8-hp. motor, belted to—
    1—6-ton York compressor. This refrigeration is used for cooling the drinking water for the building and also five storage boxes, each having a volume of 320 cu. ft. These are maintained at a temperature of 25 deg. f.

2. The refrigeration equipment consists of:
1—1-hp. Westinghouse, single-phase, 220 volt, 1800 r.p.m. motor, belted to—
    1—¼-ton Brunswick compressor. This cools one household ice box, 26 cu. ft.

3. The refrigeration equipment consists of:
1—1½-hp., d-c. motor, belted to—
    1—¼-ton Brunswick compressor. This cools one household ice box, 26 cu. ft., makes ten-pound cakes of ice when needed, and cools one cabinet holding bottled spring water, 2 cu. ft.

4. The refrigeration equipment consists of:
1—10-hp. motor, belted to—
    1—5-ton Compressor. This cools eleven ice boxes having a volume of 240 cu. ft. each. These are maintained at a temperature of 28 deg. f.

5. The refrigeration equipment consists of:
1—7½-hp. Westinghouse, CCL motor, 2-phase, 220 volt, 850 r.p.m., belted to—
    1—Triumph 4-ton 5 in. by 8 in. compressor. This cools by direct expansion, sixteen ice boxes distributed on four floors; each box about 25 cu. ft.

6. The refrigeration equipment consists of:
1—60-hp. Westinghouse motor, type S, d-c., 220 volt, 600 r.p.m., belted to—
    1—20-ton De La Vergne duplex compressor. This cools by brine circulation, food boxes about 6 ft. by 6 ft. by 3 ft. on each floor (nine floors), and five large storage boxes in the basement and makes ½ ton of ice daily.*

7. The refrigeration equipment consists of:
1—30 hp. Sprague motor, belted to—
    1—Brunswick double cylinder 12-ton compressor. This cools two storage rooms about 30 ft. by 40 ft. by 16 ft., or a total of 40,000 cu. ft. These rooms are maintained at a temperature of 34 deg. f. A small fan belted to a 1½-hp. motor is used to produce circulation in the two storage rooms.

* A 10-hp. Crocker-Wheeler motor, type CCM, d-c, 220 volt, 780 r.p.m., drives by silent chain a triplex brine pump which circulated brine through the above mentioned boxes.

REFRIGERATION DATA

PACKERS

Name	City	Kw-hr. per year	Average Maximum	Hp. Connected	Tons Refrigerating	Kw-hr. per year per Ton	Kw-hr. per year per Hp.	Refrigerating Equipment and Requirement
Cudahy Packing Co.	New York, N. Y.	12644		7½	4	3161	1690	See Note No. 1
Vienna Sausage Co.	Chicago, Ill.	6000		30	15	400	200	" " " 2
Sulzberger & Sons	Pittsburgh, Pa.	76292		30	15	5086	2543	" " " 3
Schwarzchild & Sulzberger Co.	New Orleans	51372		30	15	3424	1712	" " " 4
Swift & Co.	New Orleans	179580		120	40	5488	1496	" " " 5
Kingan & Co.	Pittsburgh, Pa.	171144		30	15	11408	5704	" " " 6

FLORISTS

Name	City	Kw-hr. per year	Average Maximum	Hp. Connected	Tons Refrigerating	Kw-hr. per year per Ton	Kw-hr. per year per Hp.	Refrigerating Equipment and Requirement
Pennock Bros.	Philadelphia, Pa.	4804		3	1	4804	1601	" " " 4
S. S. Pennock-Meeham Co.	Philadelphia, Pa.	18372		12	6	1531	3062	" " " 7

DRUG STORES

Name	City	Kw-hr. per year	Average Maximum	Hp. Connected	Tons Refrigerating	Kw-hr. per year per Ton	Kw-hr. per year per Hp.	Refrigerating Equipment and Requirement
Hegeman Drug Co.	New York, N. Y.	29433		15	8	3680	1960	" " " 8
Withheld	Providence, R. I.	70368		13	10	7036.8	5413	" " " 9

1. The refrigeration equipment consists of:
1—7½-hp. motor, belted to—
1—4-ton Compressor. This plant is practically shut down during three months of the year.

2. The refrigeration equipment consists of:
1—30-hp. G. E. motor, 800 r.p.m., 220 volt, d-c., belted to—
1—15-ton Rebsamen & Almeroth compressor.
The refrigeration requirements consist of:
One meat box, 11 ft. by 22 ft. by 10 ft., 36 deg. f., and three cured meat boxes, 8 ft. by 8 ft. by 10 ft., 36 deg. f.

3. The refrigeration equipment consists of:
1—30-hp. Westinghouse, 550 volt, 1230 r.p.m., shunt-wound motor, belted to—
1—15-ton Automatic compressor of the duplex type. The motor is belted to the compressor through a speed-reducing countershaft.
The refrigeration requirements consist of:
1—Room for meats, 52 ft. by 14 ft. by 8 ft., 36 deg. f.
1—Room for meats, 25 ft. by 12 ft. by 8 ft., 36 deg. f.
1—Room for meats, 34 ft. by 12 ft. by 8 ft., 36 deg. f.
1—Room for meats, 56 ft. by 42 ft. by 12 ft., 36 deg. f.

4. The refrigeration equipment consists of:
1—30-hp. Variable speed Allis-Chalmers motor, 220 volt, d-c., belted to—
1—15-ton Arctic double-acting compressor.
The refrigeration requirements consist of:
1—Beef room, 28 ft. by 30 ft. by 25 ft., 30 to 35 deg. f.
1—Freezing room, 14 ft. by 30 ft. by 25 ft., 28 to 32 deg. f.
1—Sundry supplies room, 45 ft. by 60 ft. by 8½ ft., 36 to 40 deg. f.

A large brine tank is installed for "hold over" as this plant does not operate more than eight hours per day at any time during the year.

5. The refrigeration equipment consists of:
2—40-hp. motors, connected to—
2—20-ton Compressors, one of which is operated continuously. On the same meter there are two 20-hp. motors connected with meat grinders, sausage stuffers and elevators.

6. The refrigeration equipment consists of:
1—30-hp., 850 r.p.m., 2-phase, squirrel-cage, Westinghouse, type M.S. motor, belted to—
1—15-ton De La Vergne compressor, single-cylinder type, and one 7½-hp. 1130 r.p.m., squirrel-cage, Westinghouse, type M.S. motor, belted to one 7-ton Remington vertical duplex compressor.
The refrigeration requirements consist of:
1—Room, 14 ft. by 33 ft. by 10 ft., 32 deg. f.
1—Room, 22 ft. by 64 ft. by 10 ft., 32 deg. f.
1—Room, 14 ft. by 33 ft. by 7 ft., 50 deg. f.
1—Room, 22 ft. by 64 ft. by 7 ft., 50 deg. f.
1—Room, 22 ft. by 25 ft. by 7 ft., 32 deg. f.
1—Room, 14 ft. by 14 ft. by 9 ft., 40 deg. f.
These coolers are used for hanging meat.

7. The refrigeration equipment consists of:
1—12-hp. C. & C. motor, d-c., 250 volt, 700 r.p.m., driven by silent chain—
1—6-ton Remington compressor, motor controlled by a 10-point speed regulator.
The refrigeration requirements consist of:
1—Freezer, 2250 cu. ft., 28 to 30 deg. f.
Refrigerator rooms, 10,700 cu. ft., 42 to 44 deg. f.

8. The refrigeration equipment consists of:
1—15-hp. motor, belted to—
    1—8-ton Brunswick compressor. This cools 240 cu. ft. to 32 deg. and 200 cu. ft. to 12 to 16 deg.

9. The refrigeration equipment consists of:
2—5-hp. d-c. motors, belted to—
    2—5-ton Compressors and one 3-hp., 500 volt, d-c. motor to pump brine.

REFRIGERATION DATA

CANDY MANUFACTURERS

Name	City	Kw-hr. per year	Average Max-imum	Hp. Con-nected	Tons Refrig-erating	Kw-hr. per year per Ton	Kw-hr. per year per Hp.	Refrigerating Equipment and Requirement
B. Allegretti Co.	Chicago, Ill.	4536	7	10	2	2268	453.6	See Note No. 1
Charles W. Miller	Philadelphia, Pa.	3720		7½	4	930	496	" " " 2
GROCERIES								
L. J. Callanan	New York, N. Y.	3723		5	1½	2480	745	" " " 3
Park & Tilford	New York, N. Y.	12429		7½	5	2490	1660	" " " 4
DAIRIES								
Withheld	Providence, R. I.	10646		10	7½	1418	1064.6	" " " 5
M. Carnahan	New Orleans, La.	6972		5	2	3486	1394	" " " 6
SALOON								
J. F. Bege	Philadelphia, Pa.	1484		3	1	1484	494	" " " 7
RESTAURANTS								
D. M. McGowan	Philadelphia, Pa.	7087		3	1	7087	2362	" " " 8
Murray's Restaurant	New York, N. Y.	43774		10	5	8756	4378	" " " 9
N. Drake	New York, N. Y.	20342		5	3	6871	4068	" " " 10
Bismarck Hotel	Chicago, Ill.	93276		60	32	2910	1551	" " " 11
CLUBS								
Players Club	New York, N. Y.	13543		7½	4	3386	1808	" " " 12

1. The refrigeration equipment consists of:
1—10-hp., G.E. motor, d-c., 220 volt, 800 r.p.m., belted to—
  1—2-ton Baker compressor.
The refrigeration requirements consist of:
  One box for chocolate creams, 25 ft. by 18 ft. by 7 ft., 55 to 60 deg. f.

2. The refrigeration equipment consists of:
1—7½-hp., Westinghouse, 2-phase, 220 volt, 690 r.p.m. motor, belted to—
  1—4-ton Remington compressor. This cools by direct expansion with brine tank auxiliary, one room 1200 cu. ft. capacity, for chocolate creams, to about 60 deg. f.

3. The refrigeration equipment consists of:
1—5-hp. motor, belted to—
  1—Brunswick compressor, 1½ ton, cooling three storage vaults, each 3240 cu. ft., to 28 deg. f.

4. The refrigeration equipment consists of:
1—7½-hp. motor, belted to—
  1—5-ton Voss compressor. This cools a storage box of 1960 cu. ft. capacity to 28 deg. f.

5. The refrigeration equipment consists of:
1—10-hp. motor, belted to—
  1—7-ton Compressor.

6. The refrigeration equipment consists of:
1—5-hp., G.E. motor, belted to—
  1—2-ton Remington compressor. This is used for pre-cooling milk and furnishing refrigeration 40 deg. f. in one box, 10 ft. by 10 ft. by 12 ft.

7. The refrigeration equipment consists of:
1—3-hp. motor, Westinghouse, 2-phase, 220 volt, 1750 r.p.m., belted to—
  1—1-ton Larson compressor. This cools one beer vault, 600 cu. ft.; two food boxes, 36 cu. ft., and one cabinet of bottled goods, about 9 cu. ft.

8. The refrigeration equipment consists of:
1—3-hp. Allis-Chalmers, d-c. motor, 220 volt, 1100 r.p.m., belted to—
  1—1-ton Brunswick compressor. This cools three food boxes, 640 cu. ft.

9. The refrigeration equipment consists of:
1—10-hp. motor, belted to—
  1—5-ton Voss compressor. This cools to 32 deg. f., 1772 cu. ft.

10. Refrigeration equipment consists of:
1—5-hp. motor, belted to—
  1—3-ton Voss compressor.

11. The refrigeration equipment consists of:
1—25-hp. motor, Western Electric, 625 r.p.m., 220 volt, d-c., belted to—
  1—12-ton Kroeschell compressor.
1—35-hp., G.E., 800 r.p.m., 220 volt, d-c. motor, belted to—
  1—20-ton Kroeschell compressor.
The refrigeration requirements consist of:
  1—Room for vegetables 11 ft. by 5 ft. by 6 ft., 45 deg. f.
  1—Room for meat, 15 ft. by 12 ft. by 6 ft., 40 deg. f.
  1—Room for milk, 5 ft. by 1¾ ft. by 6 ft., 38 deg. f.
  1—Cook's box, 12 ft. by 2 ft. by 7½ ft., 45 deg. f.
  1—Box for butter, 24 ft. by 2 ft. by 8 ft., 45 deg. f.
  1—Box for wine, 2 ft. by 5½ ft. by 8½ ft., 35 deg. f.
  1—Box for wine, 10 ft. by 5½ ft. by 8½ ft., 30 deg. f.
  1—Box for beer, 26 ft. by 12 ft. by 7½ ft., by 45 deg. f.

12. Refrigeration equipment consists of:
1—7½-hp. motor, belted to—
  1—4-ton York compressor. This cools an ice box of 432 cu. ft. capacity and makes 12 cakes of ice, each weighing 50 lb.

REFRIGERATION DATA

FUR STORAGE

Name	City	Kw-hr. per year	Average Max-imum	Hp. Con-nected	Tons Refrig-erating	Kw-hr. per year per Ton	Kw-hr. per year per Hp.	Refrigerating Equipment and Requirement
Balch, Price & Co.	Brooklyn, N. Y.	19760		39½	20	986	565	See Note No. 1
Julius Klugman	New York, N. Y.	1931		7½	4	483	258	" " " 2
H. Jaeckel & Sons	New York, N. Y.	23000		15	10	2300	1532	" " " 3
C. G. Gunther's Sons	New York, N. Y.	27321		30	15	1821	911	" " " 4

1. Refrigeration is employed in this store for the purpose of storing fur garments during the time they are not in use, *i. e.*, for approximately eight months out of the year, usually from about March 1 to November 1, but varying according to the weather. The York system, rated at 20 tons of direct expansion is used, the expansion pipes being located in a coil room approximately 15 ft. by 18 ft. by 10 ft, or 2700 cu. ft. The cool air from the coil room is delivered to the storage vaults through ducts, by a blower direct-connected to a 4½-hp. G.E. motor. The ammonia compressor is belted to a 35-hp., 240 volt, variable speed, G.E. motor, the r.p.m. varying from 350 to 525 and corresponding to a variation of 60 to 95 r.p.m. of the compressor. The cubical contents of the vaults are as follows:

	Including Columns	Excluding Columns
South vault	31,250 cu. ft.	29,820 cu. ft.
North vault	28,900 " "	26,955 " "
Total	60,150 " "	56,775 " "

These vaults are never allowed to reach a temperature of over 32 deg. f.

2. Refrigeration is used for the storage of furs about 200 days yearly, from the middle of March to the end of September. The direct expansion system is used. The compressor is of the York type rated at 4 tons and is belted to a 7½-hp. Westinghouse motor. Water for cooling purposes passes from the condenser to the sewer. The storage room is about 40 ft. by 16 ft. by 9 ft., with a cubical volume of about 5722 cu. ft. This room is maintained at a temperature of about 20 deg. f.

The plant was installed by the Edwards Electric Co. and cost installed, complete, including compressor, motor, piping, wiring and engineering, $1,775.00 ($444.00 per ton).

3. The working conditions are the same as in the foregoing cases. The compressor is of the horizontal type, rated at 10 tons, and driven by a 15-hp. motor, by means of a chain belt. The condenser is of the double pipe type using Croton water which goes from the condenser direct to the sewer. The ammonia expansion pipes are hung from the ceiling and on the four walls of the storage room. The storage room is 60 ft. by 46 ft. by 12 ft. and a temperature of 16 deg. f. is maintained in it.

4. The working conditions are the same as in the foregoing cases. The compressor is a 15-ton York machine, 2-cylinder, and is driven through a belt by a 25-hp. motor. Ammonia expansion coils are located in a chamber adjoining the storage vaults and a 5-hp. motor on a fan is used for blowing the air into the vaults. The vault has a volume of 40,500 cu. ft. The highest temperature in the vault is 32 deg. f. The condenser is of the double pipe type and takes Croton water which is afterwards used for house service.

GENERAL NOTES

The data which can be compiled on refrigeration as used for the storage of furs, shows a rather low monthly average kw-hr. consumption because of slack business in the winter time. In the winter the cold air from the street is circulated through the storage vaults and the temperature is lowered by it.

REFRIGERATION DATA

RETAIL MEAT MARKETS

Name	City	Kw-hr. per year	Average Maximum	Hp. Connected	Tons Refrigerating	Kw-hr. per year per Ton	Kw-hr. per year per Hp.	Refrigerating Equipment and Requirement
J. J. Schnitzius	Philadelphia, Pa.	9949		15	8	1244	663	See Note No. 1
Withheld	Providence, R. I.	41360		20	8	5170	2068	" " " 2
H. Hirsch	New Orleans, La.	4340	3	8	½	4340	284	" " " 3
Herbert Reusch	New Orleans, La.	25628	3	5	½	51256	5126	" " " 4
N. Frey	New Orleans, La.	4600	4	7	2	2300	657	" " " 5
Klein Bros.	Chicago, Ill.	26808		15	8	3351	1775	" " " 6
Zambreno Bros.	Chicago, Ill.	3408	3	5	2	1704	682	" " " 7
F. P. Bell	Philadelphia, Pa.	11099		7½	4	2774	1478	" " " 8

1. The refrigeration equipment consists of:

1—15-hp. Western, CCL motor, 2-phase, 220 volt, 1800 r.p.m., driven by belt through countershaft—
  1—8-ton Huetteman & Cramer horizontal compressor at 80 r.p.m., which cools by direct expansion.

The refrigeration requirements consist of:
  The cooler containing 2200 cu. ft., is maintained at 32 deg. Another box in the retail store, containing 800 cu. ft. is maintained at 40 deg.

2. The refrigeration equipment consists of:

1—20-hp. motor, driving—
  1—8-ton Refrigerating machine which cools meat on the counter as well as in the ice box. To keep the ice box, which holds 100 cattle, at an average temperature of 40 deg.

3. The refrigeration equipment consists of:

1—3-hp. G. E. motor, connected to—
  1—½-ton De La Vergne refrigerating machine. In addition to this there are two sausage machines belted to a 5-hp. Wagner motor.

4. The refrigeration equipment consists of:

1—5-hp. G. E. motor, connected to—
  1—½-ton Remington ice machine.
  To cool a box, size 10 ft. by 12 ft. by 10 ft., to 32 deg.

5. The refrigeration equipment consists of:

1—7-hp. CC motor, connected to— -
  1—2-ton Remington ice machine.
  To cool one box, size 7 ft. by 10 ft. by 7 ft., and one box 10 ft. by 10 ft. by 10 ft.

6. The refrigeration equipment consists of:

1—15-hp., 220 volt, d-c., 800 r.p.m., G.E. motor, belted to—
  1—8-ton Kroeschell compressor.
  To cool the following—
  1—Box for meat, size 33½ ft. by 10 ft. by 10½ ft., to 38 deg.
  1—Box for cheese, size 7 ft. by 2½ ft. by 10½ ft., to 35 deg.
  1—Box for butter, size 9 ft. by 10 ft. by 10½ ft., to 30 deg.

7. The refrigeration equipment consists of:

1—5-hp., 220 volt, d-c., 1200 r.p.m., Fort Wayne motor, belted to—
  1—2-ton York compressor.
  To cool the following—
  1—Room for meat, size 11 ft. by 12 ft. by 9½ ft., to 40 deg.
  1—Room for smoked meats, size 6 ft. by 8 ft. by 9½ ft., to 50 deg.

8. The refrigeration equipment consists of:

1—7½ hp. Wagner, 2-phase motor, 220 volt, driven by belt through countershaft—
  1—4-ton Refrigerating compressor, running at 157 r.p.m. and cooling by direct expansion.
  To cool one meat box of 2366 cu. ft., one butter box of 4 cu. ft. and counter cases 20-ft. long.

REFRIGERATION DATA

HOTELS

Name	City	Kw-hr. per year	Average Max-imum	Hp. Con-nected	Tons Refrig-erating	Kw-hr. per year per Ton	Kw-hr. per year per Hp.	Refrigerating Equipment and Requirement
St. Denis Hotel	New York, N. Y.	91539		17½	10	9154	5230	See Note No. 1
Cosmopolitan Hotel	New Orleans, La.	108000		55	30	3600	1986	" " " 2

ICE CREAM—RETAIL

Name	City	Kw-hr. per year	Average Max-imum	Hp. Con-nected	Tons Refrig-erating	Kw-hr. per year per Ton	Kw-hr. per year per Hp.	Refrigerating Equipment and Requirement
C. W. Schilling	Philadelphia, Pa.	16544		10½	4	4135	1102	" " " 3

ICE CREAM—WHOLESALE

Name	City	Kw-hr. per year	Average Max-imum	Hp. Con-nected	Tons Refrig-erating	Kw-hr. per year per Ton	Kw-hr. per year per Hp.	Refrigerating Equipment and Requirement
Wieland & Kjellander	Chicago, Ill.	37464		63½	33	1135	590	" " " 5
Thompson & Co.	Chicago, Ill	46392		73	30	1543	635	" " " 6
Drexel Ice Cream Co.	Chicago, Ill.	39456		69½	30	1315	567	" " " 7
Anderson & Goodman	Chicago, Ill.	109560	41	100	45	2217	1095	" " " 8
Charles Bonini	Pittsburgh, Pa.	105470		40	20	5273	2636	" " " 9
Maryland Ice Cream and Fruit Products Co.	Baltimore, Md.	411900		225.3	80	5149	1828	" " " 10
F. W. Hoffman	Baltimore, Md.	23210		33.5	6	3868	693	" " " 11
Hendler Creamery Co.	Baltimore, Md.	166546		122.5	40	4164	1359	" " " 12

1. The refrigeration equipment consists of:
1—7½-hp. motor, connected to—
  1—10-ton York compressor.
1—2-hp. motor, connected to—
  1—Centrifugal pump for condensing water.
2—5-hp. motors, connected to—
  2—Brine pumps. One held in reserve.
The refrigeration requirements consist of:
  10—Boxes of various sizes throughout the hotels.

2. The refrigeration equipment consists of:
1—25-hp. motor, belted to—
  1—15-ton Compressor.
1—30-hp. motor, belted to—
  1—15-ton Compressor.

3. The refrigeration equipment consists of:
1—7½-hp. Westinghouse CCL motor, 2-phase, 220 volt, 850 r.p.m., silent chain drive to—
  1—4-ton Brunswick refrigerating machine.
1—3-hp. Wagner single-phase motor, 220 volt, driving line shaft which operates—
  1—Cake mixer,
  1—Ice cream machine.

4. The refrigeration equipment consists of:
1—3-hp. Peerless motor, d-c., 220 volt, 1300 r.p.m., driving by belt—
  1-ton Brunswick refrigerating machine which cools, by direct expansion, one display case, 500 cu. ft. Brine tank auxiliary.

5. The refrigeration equipment consists of:
2—25-hp. G.E. motors, belted to—
  1—15-ton Larsen compressor,
  1—18-ton Larsen compressor.
1—5-hp. N.W. motor, belted to—
  1—Creasy ice breaker.
1—2-hp. Fairbanks motor, direct connected to—
  1—Centrifugal brine pump.
1—½-hp. G.E. motor, belted to—
  1—Mixing tank.
3—2-hp. G.E. motors, belted to—
  3—12-gal. Miller freezers.
The refrigeration requirements consist of:
  1—Hardening room, 10 ft. by 10 ft. by 8 ft., 10 deg. below zero f.
  1—Storage room, 12 ft. by 14 ft. by 8 ft., 10 deg. below zero f.

6. The refrigeration equipment consists of:
1—1-hp. motor, belted to—
  1—Centrifugal pump for ice cream.
1—1-hp. motor, belted to—
  1—Centrifugal pump for brine.
1—1-hp. motor, belted to—
  1—Brush for cleaning cans.
2—5-hp. motors, running—
  6—Miller freezers.
1—10-hp. motor, belted to—
  1—No. 49 Creasy ice breaker.
2—25-hp. motors, belted to—
  2—15-ton Larsen compressors.
The refrigeration requirements consist of:
  1—Hardening and storage room, 15 ft. by 30 ft. by 15 ft., plus 5 deg. f.

7. The refrigeration equipment consists of:
All motors G.E., 3-phase, 220 volt, 60 cycle
2—25-hp. motors, belted to—
    2—15-ton Larsen compressors.
1—10-hp. motor, running—
    5—Miller freezers,
    1—Centrifugal ice cream pump.
1—7½-hp. motor, belted to—
    1—Creasy ice breaker
2—1-hp. motors, belted to—
    1—Centrifugal brine pump,
    1—Brush for cleaning cans.
The refrigeration requirements consist of:
    1—Hardening and storage room, 28 ft. by 21 ft. by 10 ft., zero deg. f., also furnishes brine for freezers. This factory makes 250,000 gal. of cream a year.

8. The refrigeration equipment consists of:
1—50-hp. motor, belted to—
    1—30-ton Larsen compressor.
1—25-hp. motor, belted to—
    1—15-ton Larsen compressor.
1—3-hp. motor, belted to—
    1—Centrifugal brine pump.
1—1½-hp. motor, belted to—
    1—Centrifugal ice cream pump.
1—1½-hp. motor, belted to—
    1—Suction pump.
6—2-hp. motor, belted to—
    6—10-gal. Miller freezers.
1—7½-hp. motor, belted to—
    1—Ice breaker.
The refrigeration requirements consist of:
    1—Hardening and storage room, 20 ft. by 30 ft. by 9 ft., 5 deg. below zero deg. f.

9. The refrigeration equipment consists of:
1—40-hp., 495 r.p.m., phase-wound, Westinghouse, Type HF motor, belted to—
    1—20-ton York compressor.
The refrigeration requirements consist of:
    1—Hardening room, 9 ft. by 18 ft. by 7 ft., 6 deg. f.; 1—storage room, 16 ft. by 12 ft. by 8 ft., 36 to 40 deg. f. This plant uses ice in the mixers.

10. Service—Motors, 240-volt, direct current.
Lighting 120-volt, 3-wire, direct current.
2—75-hp, 300/600 r.p.m. Garwood motors, driving—
    2—40-ton, 9 in. by 18 in. duplex, double acting, horizontal York compressors. Motor pulleys 20 in. dia. by 17½ in. face, compressor flywheels, 10 ft.; pulley centers, 19 ft.; belts, 15½ in.
1—7½-hp., 1140 r.p.m., Crocker-Wheeler motor, driving—
    1—No. 49 Creasey ice crusher. Pulley motor, 4½ in. diameter; crusher, 4 in. dia.
1—5-hp., 1650 r.p.m., Garwood motor, direct connected to—
    1—Gould 2 in. volute pump, for pumping hot brine.
1—15-hp., 750/1500 r.p.m., General Electric motor, direct connected to—
    1—3 in. Worthington volute pump, for cold brine circulation.

1—7½-hp., 820 r.p.m., Garwood motor, direct connected to—
    1—30 in. Bicalky hardening room fan.
6—2-hp., 1140 r.p.m., Westinghouse motors, operating—
    10 gal. Ice cream freezers, chain drive.
1—1-hp., 1275 r.p.m., General Electric motor, driving—
    1—150 gal. Cream mixer.
1—1½-hp., 850 r.p.m., vertical Crocker-Wheeler motor, direct connected to—
    1—York 9 in. agitator for brine circulation in ice tank.
1—1-hp., 900 r.p.m., General Electric motor, driving—
    1—100 gal. Cream agitator (Creamery Package Mfg. Co.). Agitator 50 r.p.m., driven by jack shaft.
1—7½-hp., 975 r.p.m., Westinghouse motor, driving—
    1—Manton Gaulin Mfg. Co. homeogenizing machine.
1—1/3-hp., 1120 r.p.m., Standard motor, operating—
    1—No. 5 A Miller pasteurizer.
2—7½-hp., 1120 r.p.m., General Electric motors, driving—
    Elevators, belt drive.
1—2-hp., 1120 r.p.m., General Electric motor, driving—
    1—No. 49 Creamery Package Co., can washer, chain drive.
Lighting, 4 kw., 40 and 60-watt tungsten lamps.

REMARKS

This plant has four hardening and ice cream storage rooms, 5 ft. by 22 ft. by 8 ft. high on second floor. Immediately above are three cream storage rooms 8½ ft. by 17 ft. by 15 ft. high, also fruit products storage room 12½ ft. by 22 ft. by 15 ft., and brine tank room 5 ft. by 25½ ft. by 15 ft. high.

The cold storage rooms consume probably 40 per cent of refrigeration produced.

The figure given per unit of product, 2.76 kw-hr., includes consumption for cold storage, ice cream and ice.

MONTHLY OPERATING FIGURES
1912

Month	Mean Temp.	Gallons Ice Cream	Tons Ice	Cubic Feet Water
May	65.4	15,181	304	234,280
June	71.4	24,733	492	575,650
July	76.5	33,489	542	745,330
August	74.2	28,685	557	776,000
September	70.6	23,557	428	702,880
October	61.1	11,817	265	348,640
November	48.7	7,142	178	156,870
December	38.6	4,280	109	60,410
Total	506.5	148,884	2,875	3,600,060

11. All motors 3-phase, 60-cycle, 230 volt.
1—20-hp., HF. Westinghouse motor, 900 r.p.m., with 8 in. by 8 in. pulley, driving—
    6-ton York single acting, vertical ammonia compressor, flywheel of compressor 36 in., pulley centers 12 ft., belt 7 in., double ply.
1—5-hp., CCL, Westinghouse motor, driving line shafting, operating—
    2—10 gal. Ice cream freezers,
    1—No. 1 Creasey ice crusher.
1—7½-hp., 1750 r.p.m., Richmond motor, operating—
    1—Elevator.
1—1-hp., 1200 r.p.m., CCL, Westinghouse motor, driving—
    1—Brine pump.

REMARKS

The customer has two hardening and storage rooms, each 12 ft. by 12 ft. by 7 ft. high, brine circulation, uses city water and buys all ice.

Lighting, 2 40-watt lamps.

Mean temperatures: April, 1912, 54.6; May, 65.4; June, 71.4; July, 76.5; August, 74.2; September, 70.6; October, 61.1; November, 48.7; December, 38.6.

12. Service—Motors, 3-phase, 60-cycle, 230-volt.
Lighting, 3-wire, 60-cycle, single-phase, 115-volt.

1—75-hp., H.F, Westinghouse, 900 r.p.m., with rotor resistance control, driving—
  1—40-ton Single-acting vertical York ammonia compressor. Motor pulley 14 in. by 20 in.; compressor flywheel, 9 ft.; belt, 18 in., double ply; pulley centers, 21 ft.
1—7½-hp., 200 r.p.m., CCL, Westinghouse motor, belted to—
  1—No. 2 Creasey ice crusher.
1—5-hp., 1200 r.p.m., CCL, Westinghouse motor, direct connected to—
  1—2 in. Alberger centrifugal brine pump.
1—5-hp., 1200 r.p.m., CCL, Westinghouse motor, direct connected to—
  1—24 in. Bicalky fan.
4—2-hp., 1200 r.p.m., CCL, Westinghouse motors, each driving—
  1—10 gal Ice cream freezer, chain drive.
1—7½-hp., 900 r.p.m., CCL, Westinghouse motor, driving—
  1—Homeogenizing machine by belt.
1—2-hp., 200 r.p.m., CCL, Westinghouse vertical motor, direct connected to—
  1—9 in. York vertical agitator for ice tanks.
1—2-hp., 1200 r.p.m., CCL, Westinghouse motor, driving—
  1—Can washer, chain drive.
1—½-hp., 1200 r.p.m., CCL, Westinghouse motor, driving—
  1—150 gal. Cream mixer.
1—10-hp., 1200 r.p.m., Richmond motor, operating—
  1—3000 lb. Elevator.

Lighting—6.25 kw. 507 60-watt tungstens.
2.50 kw. electric signs.

REMARKS

The foregoing figures for kilowatt-hour consumption include lighting.

The customer makes his own ice and uses city water.

Mean temperatures: June, 1912, 71.4; July, 76.5; August, 74.2; September, 70.6; October, 61.1; November, 48.7; December, 38.6.

ICE PLANT DATA

Name	Knickerbocker Ice Co. (61st St. Plant)
City-State	Chicago, Ill.
Business	Manufacturers of ice
Process	Distillated water—can system
Drive	Individual

Running hours per week 168.
Rated daily capacity of plant in manufactured output—120 tons ice
Actual output during the year covered—(8 months), 32,500 tons
Name of central-station company furnishing service—C. E. Company

KILOWATT-HOURS FOR 8 MONTHS

1912	Kw-hr.	1912	Kw-hr.	1912	Kw-hr.		Kw-hr.
May	117000	Aug.	216700	Nov.	152445		
June	190000	Sept.	205802	Dec.	160619		
July	211000	Oct.	204312				

Total connected hp. (additional 100 hp. added in 1913)	564
Total number motors installed	20
Average kw-hr. per month	182,239
Average kw-hr. per month per connected hp.	323
Kw-hr. per unit of manufactured product, per ton	44.7
Measured maximum demand (duration of peak, 30 minutes), kilowatts	364

INSTALLATION

The installation of this plant consists of the following:

All motors Wagner 230-volt, 60-cycle, 3-phase.

2—200-hp. motors, belted to—
    2—50-ton York compressors
8—2-hp. motors, on—
    8—Agitators
1—75-hp. motor, on—
    1—Deep well pump
1—40-hp. motor, on—
    1—Centrifugal water pump
2—5-hp. motors, on—
    2—Centrifugal brine pumps
1—10-hp. motor, on—
    1—Elevator
2—1-hp. motors, belted on—
    2—Cranes
1—3-hp. motor, on—
    1—Coal hoist
1—3-hp. motor, on—
    1—Mechanical stoker
1—3-hp. motor, on—
    1—Coal conveyor
1—100-hp.. 720 r.p.m., Nector motor, operating—
    1—Air compressor for pumping water (was added in 1913)

ICE PLANT DATA (*Continued*)

Name	Knickerbocker Ice Co. (65th St. Plant)
City–State	Chicago, Ill.
Business	Ice manufacturer
Process	Distillated water—can system
Drive	Individual

Running hours per week 168
Rated capacity of plant in manufactured output—90 tons per day
Actual output during the year covered—(5 months), 9005 tons
Name of central-station company furnishing service—C. E. Company

KILOWATT-HOURS FOR 5 MONTHS

1912	Kw-hr.	1912	Kw-hr.		Kw-hr.		Kw-hr.
June	60150	Sept.	143148				
July	165000	Nov.	44526				
Aug.	156000						

Total connected hp.	375
Total number motors installed	13
Average kw-hr. per month	113,765
Average kw-hr. per month per connected hp.	301
Kw-hr. per unit of manufactured product	63
Measured maximum demand (duration of peak, 30 minutes), kilowatts	248

INSTALLATION

The installation of this plant consists of the following:
All motors Wagner, 3-phase, 60-cycle, 230-volt

2—150-hp., slip-ring motors, 514 r.p.m., belted to—
  2—45-ton York compressors
4—2-hp. motors, on—
  4—Agitators
1—30-hp. motor, on—
  1—Deep well pump
1—20-hp. motor, on—
  1—Auxiliary deep well pump
2—1-hp. motors, on—
  2—Cranes
3—5-hp. motors, on—
  3—Coal conveyors

ICE PLANT DATA (*Continued*)

Name	Englewood Distilled Water Ice Co.
City-State	Chicago, Ill.
Business	Manufacturers of ice
Process	Distilled water—can system
Drive	Individual

Running hours per week 168
Rated capacity of plant in manufactured output—80 tons per day, 1912
Actual output during the year covered—(5 months), 8651 tons
Name of central-station company furnishing service—C. E. Company

KILOWATT-HOURS FOR 5 MONTHS

1912	Kw-hr.	1912	Kw-hr.		Kw-hr.		Kw-hr.
May	136300	Aug.	108531				
June	62400	Sept.	57927				
July	122500						

Total connected hp. (added 150 hp. in 1913 to operate a 40-ton compressor)	302
Total number motors installed	9
Average kw-hr. per month (5 months)	97,531
Average kw-hr. per month per connected hp.	312
Kw-hr. per unit of manufactured product	56.3
Measured maximum demand (duration of peak, 30 minutes), kilowatts	236

INSTALLATION

The installation of this plant consists of the following:

All motors General Electric, 3-phase, 230-volt, 60-cycle

1—250-hp. motor, 450 r.p.m., belted to—
  1—80-ton York compressor
2—15-hp. motors, on—
  2—Circulating pumps
4—3-hp. motors, on—
  4—Agitators
2—5-hp. motors, on—
  2—Cranes
1—150-hp. motor, 600 r.p.m., belted to—
  1—40-ton York compressor, added in 1913

ICE PLANT DATA (*Continued*)

Name	Webster-Citizens Co. (Mechanic St. Plant)
City–State	Buffalo, N. Y.
Business	Manufacturing ice
Process	Can system with distilled water
Drive	Individual

Running hours per week 168
Rated yearly capacity of plant in manufactured output—32,850 tons ice
Actual output during the year covered—33,002 tons of ice
Name of central-station company furnishing service—The Cataract Power & Conduit Co.

KILOWATT-HOURS FOR 12 MONTHS

1912	Kw-hr.	1912	Kw-hr.	1912	Kw-hr.	1912	Kw-hr.
Jan.	92530	Apr.	133550	July	157640	Oct.	154090
Feb.	65080	May	139550	Aug.	156700	Nov.	76460
Mar.	71870	June	145686	Sept.	160250	Dec.	91210

Total connected hp.	427
Total number motors installed	14
Average kw-hr. per month	120,384
Average kw-hr. per month per connected hp.	281.9
Kw-hr. per unit of manufactured product	43.77
Measured maximum demand (duration of peak, 30 minutes), kilowatts	230

INSTALLATION

The installation of this plant consists of the following:

All motors are 3-phase, 25-cycle, induction, either 2200-volt or 440-volt, as follows:

2200-VOLT MOTORS

2—175-hp., 500 r.p.m., variable speed motors, each belted to—
    1—Vertical duplex, single-acting, 45-ton (ice), 72 r.p.m. ammonia compressor

440-VOLT MOTORS

1—25-hp., 750 r.p.m., variable speed, motor, belted to—
    1—Condenser pump
1—10-hp., 750 r.p.m., variable speed, motor, belted to—
    1—Pumping out pump
4—5-hp., 750 r.p.m., constant speed motors, direct connected to—
    Brim agitators
1—5-hp., 750 r.p.m., variable speed motor, geared to—
    1—Soft water pump.
1—5-hp., 750 r.p.m., variable speed motor, geared to—
    1—Boiler feed pump
1—5-hp., 750 r.p.m., variable speed motor, belted to—
    1—Distilled water pump
2—3-hp., 750 r.p.m., variable speed motors, operating—
    Cranes
1—1-hp., 750 r.p.m., constant speed motor, belted to—
    1—Water softener mixer

All ice manufactured in this plant is made from distilled water, supplied through a 12-cell multiple effect distilling equipment, requiring on the yearly average 4 tons of coal for 24 hours, or 1460 tons of coal for the year's output.

ICE PLANT DATA (*Continued*)

Name	Lincoln Ice Co.
City–State	Chicago, Ill.
Business	Ice manufacturers
Process	Raw water—can system
Drive	Individual

Running hours per week 168.
Rated capacity of plant in manufactured output—120 tons ice per day
Actual output during the year covered—27,839 tons
Name of central-station company furnishing service—C. E. Company

KILOWATT-HOURS FOR 12 MONTHS

1912	Kw-hr.	1912	Kw-hr.	1912	Kw-hr.	1913	Kw-hr.
Mar.	76600	July	237500	Nov.	71308	Jan.	48447
Apr.	97100	Aug.	224000	Dec.	32001	Feb.	68486
May	127300	Sept.	192551				
June	167300	Oct.	112419				

Total connected hp.	511
Total number motors installed	11
Average kw-hr. per month	121,251
Average kw-hr. per month per connected hp.	238
Kw-hr. per unit of manufactured product	52.2
Measured maximum demand (duration of peak, 30 minutes), kilowatts	362

INSTALLATION

The installation of this plant consists of the following:

1—150-hp., G. E., 3-phase, 60-cycle, 230-volt, 514 r.p.m., slip-ring motor, belted to—
  1—60-ton Giant ball compressor
1*—300-hp., G. E., 3-phase, 60-cycle, 230-volt, 514 r.p.m., slip-ring motor, belted to—
  1—120-ton Giant ball compressor
2—15-hp., G. E., 3-phase, 60-cycle, 230-volt motors, belted to—
  2—Air compressors
1—2-hp., G. E., 3-phase, 60-cycle, 230-volt motor, belted to—
  1—Agitator
1—2-hp. G. E., 3-phase, 60-cycle, 230-volt motor, direct connected to—
  1—Distilled water pump
2—1-hp. G. E., 3-phase, 60 cycle, 230-volt motors, direct connected to—
  2—Vacuum pumps
2—10-hp., G. E., 3-phase, 60-cycle, 230-volt motors, on—
  2—Condensers
1—5-hp., G. E., 3-phase, 60-cycle, 230-volt motor, direct connected to—
  1—Hoist

* Denotes operated separately.

ICE PLANT DATA (*Continued*)

Name	Crystal Ice Co.
City–State	Chicago, Ill.
Business	Raw water—can system
Drive	Individual

Running hours per week 168
Rated capacity of plant in manufactured output—60 tons per day
Actual output during the year covered—(10 months), 9656
Name of central-station company furnishing service—C. E. Company

KILOWATT-HOURS FOR 10 MONTHS

1912	Kw-hr.	1912	Kw-hr.	1912	Kw-hr.	1913	Kw-hr.
June	91200	Sept.	109697	Dec.	933	Jan.	24243
July	123400	Oct.	45959			Feb.	29450
Aug.	119800	Nov.	32064			Mar.	45450

Total connected hp.	235
Total number motors installed	7
Average kw-hr. per month	62,218
Average kw-hr. per month per connected hp.	254
Kw-hr. per unit of manufactured product	64.5
Measured maximum demand (duration of peak, 30 minutes), kilowatts	233

INSTALLATION

The installation of this plant consists of the following:

All motors Ft. Wayne, 3-phase, 230-volt, 60 cycle

1—150-hp. motor, belted to—
    1—60-ton Wolf compressor
1—25-hp. motor, belted to—
    1—15-ton Wolf refrigerating machine
1—20-hp. motor, belted to—
    1—Air compressor
2—5-hp. motors, connected to—
    2—Agitators
1—25-hp. motor, connected to—
    1—Deep well pump
1—5-hp. motor, connected to—
    1—Crane

ICE PLANT DATA (*Continued*)

Name	Crystal Ice & Storage Co.
City–State	Buffalo, N. Y.
Business	Manufacturing ice
Process	Plate system, with raw water
Drive	Individual

Running hours per week 168
Rated yearly capacity of plant in manufactured output—47,450 tons of ice
Actual output during the year covered—16,243 tons of ice
Name of central-station company furnishing service—The Cataract Power & Conduit Co.

KILOWATT-HOURS FOR 12 MONTHS

1912	Kw-hr.	1912	Kw-hr.	1912	Kw-hr.	1912	Kw-hr.
Jan.	1680	Apr.	73440	July	182640	Oct.	76560
Feb.	1040	May	73776	Aug.	159440	Nov.	61680
Mar.	35920	June	78560	Sept.	106160	Dec.	87200

Total connected hp.	352.5
Total number motors installed	16
Average kw-hr. per month	78,175
Average kw-hr. per month per connected hp.	221.7
Kw-hr. per unit of manufactured product	57.75
Measured maximum demand (duration of peak, 2 minutes), kilowatts	297.4

INSTALLATION

The installation of this plant consists of the following:

All motors are 3-phase, 25-cycle, induction, either 2200-volt or 220-volt, as follows:

2200-VOLT MOTORS

1—200-hp., 375 r.p.m., variable speed motor, driving by rope—
    1—Horizontal, double-acting, 100-ton (ice), 60 r.p.m. ammonia compressor
1—100-hp., 375 r.p.m., constant speed motor, driving by rope—
    1—Horizontal, double-acting, 30-ton (ice), 60 r.p.m., ammonia compressor

220-VOLT MOTORS

1—7½-hp., 750 r.p.m., constant speed, belt driven to—
    1—Rotary blower
1—6-hp., 1500 r.p.m., constant speed motor, direct connected to—
    1—Centrifugal pump
3—5-hp., 750 r.p.m., variable speed, crane motors
3—3-hp., 750 r.p.m., variable speed, crane motors
1—3-hp., 1500 r.p.m., constant speed motor, belt driven to—
    1—Centrifugal pump
1—3-hp., 1500 r.p.m., constant speed motor, chain driven to—
    1—Ice saw
1—3-hp., 1500 r.p.m., constant speed motor, geared to—
    1—Ice elevator
3—2-hp., 1500 r.p.m., constant speed motors, geared to—
    Tipping tables
1—1-kw. transformer, 220-volt to 4-volt, 250-ampere, for removing lifting rods from ice cakes
2—7.5-kw. transformers, 2200-volt to 220-volt for supplying low voltage to the above motors

The water used for the manufacture of ice in this plant is taken from the city supply, filtered and then aerated.

APPENDIX D

SUMMARY

REPRESENTATIVE ICE PLANTS USING CENTRAL-STATION POWER

DISTILLED WATER PLANTS (CAN PLANTS)

Plant	Rated capacity per day tons	Total connected load Hp.	1912 Data yearly Kw. max dem.	Rated capacity maximum demand per ton	Yearly ice output tons	Annual Kw-hr.	Average Kw-hr. per ton of ice	Months of operation
Knickerbocker Ice Co., 61st St. Plant, Chicago	120	564	364	3.0 kw.	37,205	1,457,912	44.7	8
Knickerbocker Ice Co., 65th St. Plant, Chicago	90	375	248	2.7 kw.	9,005	568,824	63	5
Englewood Distilled Water Ice Co., Chicago	80	302	236	3.0 kw.	8,651	487,658	56.3	5
Webster-Citizens Co., Mechanics St. Plant, Buffalo, N. Y.	90	427	230	2.5 kw.	33,002	1,444,608	43.7	12
RAW WATER PLANTS (CAN PLANTS)								
Lincoln Ice Co., Chicago	120	511	362	3. kw.	27,839	1,455,012	52.2	12
Crystal Ice Co., Chicago	60	235	233	3.9 kw.	9,656	622,186	64.5	10
RAW WATER PLANTS (PLATE SYSTEM)								
Crystal Ice & Storage Co., Buffalo, N. Y.	130	352.5	297.4	2.3 kw.	16,243	938,100	57.7	12

DISCUSSION

Mr. H. C. Cochran, Chicago: Mr. Jones has not said anything at all about the combination of ice plants with central-station plants. We have put in a large number of such plants of the absorption type. I think electrically driven compression ice plants will pay only in large cities, such as Buffalo and Chicago, where electric current can be furnished at a low rate per kilowatt-hour, or the ice sold at a flat rate per ton. Even in such cases it will cost from 55 to 60 cents per ton.

In existing ice plants we can make ice as a by-product, using the exhaust from compression machines, but we can do materially better when we install plants directly with the central-station. One such plant, recently installed is in Lexington, Kentucky, where they have two 2500 kw. turbines. This is a 60-ton plant, and is using the exhaust from one 75-hp. Terry turbine, driving a centrifugal water-circulating pump. The deficiency in distilled water is made up by the condensate from the large turbines, which are, of course, run condensing. They have absolutely no trouble from oil in the distilled water from the turbines. They are making ice at a cost so low that I am not permitted to mention it.

We have a plant in Chicago, where they ought to make ice cheaper than in any plant in the country when it gets to working properly. It is in connection with the Union Stock Yards & Terminal Co. power-house. There is only a small motor-driven pump. They run their big engine at three pounds back pressure throughout the year for heating purposes, and, as ours is a summer heating proposition it gives them needed additional summer load. A portion of the water required for the yards passes through our machine, hence no extra pumping is required. In fact, the principal cost of making the ice is the labor of moving it about.

I think a great many managers will find it profitable to add ice plants to their electric lighting plants, especially in the smaller cities.

Mr. T. I. Jones, Brooklyn: On the question of cost, brought up by the last speaker, I would like to tell you an experience that we had in Brooklyn. As Mr. Jones has pointed out, in a raw water plant it is not necessary to distill more than a small portion of the water, the part used in the core. The idea is that as the ordinary raw water freezes the impurities go to the center and a very small portion of distilled water is run in and that is frozen.

Now, we had in our schedule a rate of $70 a kilowatt-year for paper making, that being a high load-factor rate. As the load-factor became less the rate went higher. It is a fact that the ice-making business is a 24-hour load, except during the cold months of the year (in our climate, December, January, February and March), when the plant is not run to full capacity. The past winter in New York was very mild, so we adopted this $70 per kilowatt-year paper rate, and added another step; a rate of $80 per kilowatt-year, with a guarantee of $30,000 annually, with the proviso that during the months of January, February and March, from the hours of five to nine p. m., not more than 15 per cent of the demand would be used. Now, with this $80 rate we can compete with the steam-driven plants.

Mr. R. H. Tillman, Baltimore: In reference to absorption machines I would like to say that it would be very interesting if complete data could be compiled—that is, reliable data on their actual operation. It has been my experience, and I think that of most of the members of the Committee, that it is next to impossible to get any reliable figures from the actual operating conditions of these machines, especially in connection with the amount of water used and the temperature of that water.

We have had some experience with absorption machines in Baltimore. We have found very interesting guarantees made on these, and all such guarantees were based on the use of exhaust steam. The owners of this type of machine were thoroughly convinced that only exhaust steam was used for their engines and pumps. Two plants were investigated and it was found that one of the absorption machines was operating on 55 pounds of live steam and the other at 34 pounds, supplied by the use of reducing valves.

The absorption machine is an efficient piece of apparatus under some conditions, and these conditions exist only where exhaust steam is plentiful at the right time and cooling water is very cheap.

One other important point which should be noted in connection with refrigeration is the relative cost of water for additional cooling effect and the additional cost of power when operated at a higher temperature, and therefore, at higher pressures. It would be well for us to have the temperature of the water and the amount of water used by all of the plants on which we have collected data. This information, in addition to the mean atmospheric temperatures, would show whether it would be more economical to use additional power at the lower rate on a sliding scale schedule than to use larger quantities of water, the cost of which might overbalance the cost of power to operate the compressors at higher pressures.

I am very sorry not to be able to present some figures on the operation of what I believe is the first complete electrified brewery in the country, operated from central-station service. It has now been operating for a little over six weeks, so far as the compressors are concerned, but all of the equipment and pumps have not as yet been completely changed over. About 800 hp. in motors are used in this installation; duplicate 125-ton new refrigerating machines are each driven by 250-hp. field control, variable speed, 230-volt, direct-current motors. All pumps, air-compressors and bottling machinery will be electrically driven. This plant originally had Corliss engine-driven machines.

I hope to be in position to give you some very interesting figures as to operation later on. Thus far, the operation is very encouraging, both to the mangement of the brewery and the central station.

Mr. L. H. Egan, Kansas City, Mo.: The first speaker who discussed this paper told of getting this business at a cent a kilowatt-hour and later on Mr. Jones told us of getting the business at $80 a kilowatt-year. I presume the coal cost more in the one case than in the other. In Missouri, it is quite impossible for us to get this business at a cent and a third a kilowatt-hour, which would be about what the Brooklyn rate would figure. I would like to get some idea from Mr. Jones as to what coal costs in Brooklyn. We cannot get the business at that price.

Mr. H. S. Porter, El Paso, Texas: We have competitive towns in Texas, and we naturally do not like to give our figures away, but if any one will write us directly we shall be glad to give information. We originally had down there a compression machine which gave us a lot of trouble. We looked into the question pretty thoroughly and finally accepted a contract proposition from a Chicago firm. We found, after taking everything into consideration, that we could not manufacture current at our own power-house switchboard as cheaply as we can get it on the proposition of the Chicago people.

THE CHAIRMAN, Mr. E. W. LLOYD: I will ask Mr. Tait to take the chair because I want to say a word on this subject. We are talking about two different propositions, it seems to me. The paper is on the subject of refrigeration and ice making, and discusses the sale of electric power to people who make a business of selling ice. There are very few central stations in the ice business in this country. Possibly, there are a number of plants in the South, but in the North there are relatively few. In a community where an ice company handles the ice business alone, the central-station company could not very well afford to go into the ice-making business. I know very little about the efficiency of the absorption system as it pertains to the making of large amounts of ice, and the point I want to make is that in a large number of communities it would not be policy for the central station to start a competing ice plant. With the reasonably efficient apparatus of the station and under conditions where it is necessary to have the source of supply near the customer, it would be much better to sell current to the ice company.

Our ice-making customers tell me that one of the most difficult things to contend with is the cost of distribution of the ice, and if the central-station company can sell the power to them at a reasonable price, along the lines of the Chicago rate, there will be no question about the use of steam as against electricity.

No purchaser of electric power, so far as I know, will ever admit for a moment that he is buying power from you as cheaply as he can make it himself. It is not human nature to admit these things, and, therefore, we can not expect anybody to admit that the price we are making is a low price. They all want a lower price, of course, but I notice that our ice plants have doubled in the last nine or ten months, with more in prospect.

There are a lot of conditions surrounding the manufacture of artificial ice by the ammonia compression process that are not any too well known. When you go into the literature on the subject and try to get some facts as to the amount of power it requires to make ice, not only to run the compressors themselves, but to run the auxiliaries, you will find very little information. The electric motor, with the meter behind it, is the only method I know by which you can tell exactly how much power is being used. There is no other way to do it. There is not a steam meter on the market that will show you exact everyday conditions.

We have proved to these ice makers exactly what it costs to make a ton of ice. There are very good reasons for variations in the amount of power required at different times of the year, one of the most important being the temperature of the cooling water. You will notice that in the plants in Buffalo, the average kilowatt-hour per ton is lower than in Chicago. The reason is that the water rate in Buffalo is less than half of that in Chicago, and in Buffalo the city water is allowed to flow over the condensors instead of running it over the towers for cooling. We had a plant which operated this way in Chicago and we secured practically the same results as in Buffalo. There are some instances where artesian wells have been installed in order to bring about this condition. Whether the cost of running water more than offsets the increased efficiency obtained I have no way of knowing; but the point is important and one of the things that we ought to settle speedily. How much can a man pay for cooling water as against the cost of electricity. When we went into the ice business we spent a lot of money, and hired an outside engineer to give us information, as we did not want the prospective customer to say we were prejudiced. On the first contract we made a guarantee. Guarantees are bad things, generally, but in developing business it is a good thing to use them to a limited extent. Those first guarantees run out next month and they will not be renewed. This guarantee was 50 cents per ton of ice manufactured for power. The customers guarantee us, in turn, an annual load-factor of 60 per cent. They thought they could do it, and after we had investigated in Buffalo and other places in this latitude, a 60 per cent load-factor was decided upon as a reasonable guarantee. We now guarantee a rate of one cent per kilowatt-hour on 60 per cent load-factor, off-peak.

We have taken considerable pains in an investigation of the real load-factor of these plants in this latitude, and have come to the conclusion that it cannot be 60 per cent; that 50 per cent load-factor is about all we can get out of it. A partial reason for this is that the demand of any plant is determined by high humidity during certain days in summer.

An interesting comparison of data that we have collected on these plants, and which indicates the load or demand every half-hour during the year, shows that the demand in every one of these plants came on different days in the summer time. You will notice that the maximum demand in these plants varies from two and a half kw. to three kw. per ton capacity.

It makes little difference to a central station what the demand is in the summer time, within a reasonable limit. We, therefore, decided that as the demand came in the summer, and as it might vary 15 or 20 per cent due to atmospheric conditions, it was against our own interest to demand a load-factor of 60 per cent. We called in some of the more intelligent ice manufacturers and on the strength of what they told us we have revised our proposition and make the rate at either 60 per cent annual or 75 per cent monthly load-factor. I am sure that the manufacturers will have no difficulty in maintaining a monthly load-factor of 75 per cent, between the first of April and the first of October.

This business is extremely valuable; and in answer to the gentleman from Kansas City, I will say that we are sure we are equalling the costs in steam-driven plants. The cost of coal here is as high as in Kansas City, and, therefore, I believe that by putting a good engineering salesman on the job you will get the rates I have mentioned.

Mr. Porter: I do not want the Convention to be in error. If we had come into the field as a manufacturer of ice strictly, and not as a central station, with ice as a by-product, we would have gone to the central station for power.

Mr. T. I. Jones: I want to emphasize what Mr. Lloyd has just said. The chief reason why we get the business is the high haulage cost.

The Chairman: The second number on the program is a paper by Mr. W. A. Thomas, of Pittsburgh, on Central-Station Power in Coal Mines.

CENTRAL-STATION POWER IN COAL MINES

The sale of power, except possibly in connection with hydroelectric development, has long been associated with lighting companies whose geographical location limits their market largely to power load.

It is natural that this should be so because of the fact that lighting companies were originally capitalized on the revenue derived from lighting loads and when first entering the field for the sale of power, were not obliged to carry as high fixed charges against the power load. With the increase in power loads, however, a gradual equalization of rate has been made so that each class of service bears its proportion of the fixed charges. Very few, if any, of our combined power and lighting companies could survive on either class of service alone at the present rates.

Although many coal mines are in close proximity to central power stations, it was not until rather recently that it was possible to interest the mine operator with his low cost of fuel in the purchase of power. Why should he help to pay the freight on coal used to make the power he would buy? The power company answers, "Is it not your business to mine coal at a profit?" This admittedly being the case, it is then the business of the power company to burn coal at a profit and in so doing, it is found that another freight is to be paid, *i. e.,* that for carrying the investment over light load periods.

A careful analysis shows this to be the greatest factor in the cost of power generated in the average isolated mine plant, but until very recently the mine operator did not appreciate this fact.

Central stations relatively close to coal mines are becoming more and more interested in this field and indeed in some cases, large central energy plants are being built primarily for the supply of power to coal mines. In these latter cases the question of lighting loads becomes a secondary matter and shows somewhat of a revolution in the business of power distribution. A great deal of study is now being given to this field of central station activity and much valuable information is being presented bearing on the subject.

As the anthracite coal fields are comparatively restricted, our consideration of the question will be confined to bituminous coal production.

The last annual report of your Secretary shows a central-station revenue of approximately $4.50 per capita within the range of the service lines, or if we are informed correctly, approximately $2.25 per capita over the entire country. If we assume as average price of 5 cents per kw-hr., this would show a power consumption of approximately 4,050,000,000 kw-hr.

The annual production of coal is approximately 400,000,000 tons and careful investigation shows a power consumption of from 1½ to 3½ kw-hr. per ton when mined according to modern practise with electric power. A conservative value would be 2½ kw-hr. per ton. If it were possible to serve all coal mines with power, this would show a possible market of approximately 1,000,000,000 kw-hr. per year or a 25 per cent increase over the present power consumption.

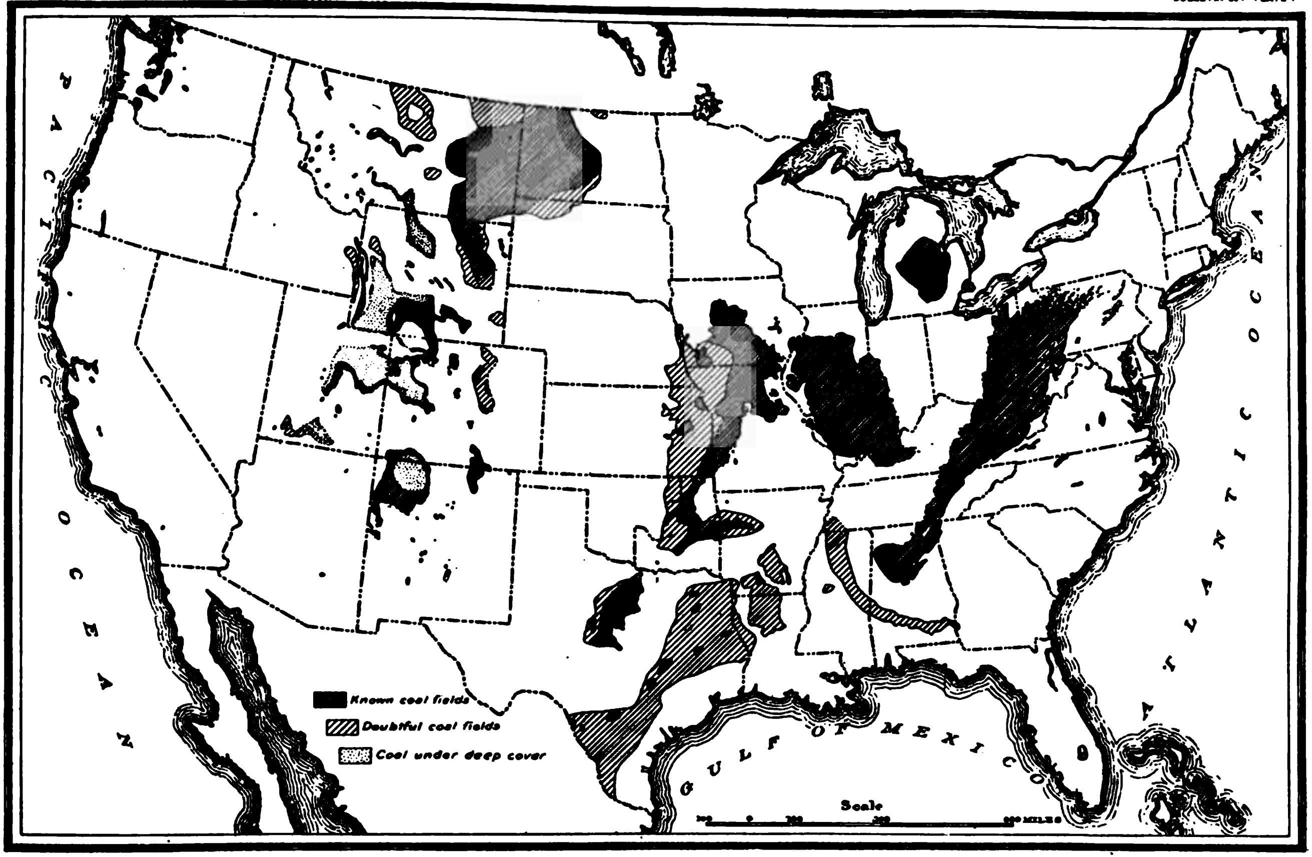
It is not, however, to be presumed that all mines are so located as to make electric service practicable, but these figures are conservative as to the possible market for power.

Fig. 1, from U. S. Geological Survey Bulletin No. 394, shows geographically the distribution of the coal fields in the United States.

As previously stated the load is, in the main, off peak as far as lighting is concerned, but in many cases some fairly steady all-night loads may be expected. Fig. 2 shows a fairly typical 24-hour load curve for an isolated coal mine plant serving three different mines, having a fairly high night load of pumping, ventilating and coal cutting and with an occasional use of locomotives for a part of the night. When the pumping load is a factor arrangements can frequently be made that the water be allowed to accumulate during the lighting peak, and the pumps started as the peak drops off in the evening.

The load factor in mining operations is, generally speaking, low, owing to light loads at night. When combined with lighting systems with low day loads they form the basis of a greatly improved load factor. A very careful study of 56 mine plants in West Virginia shows an average station capacity of 200 kilowatts installed with an average load factor of 26 per cent, based on the ratio of average kilowatt-hours per day, divided by the

U. S. GEOLOGICAL SURVEY BULLETIN 394 PLATE I



DISTRIBUTION OF COAL FIELDS IN THE UNITED STATES.

FIG. 1.

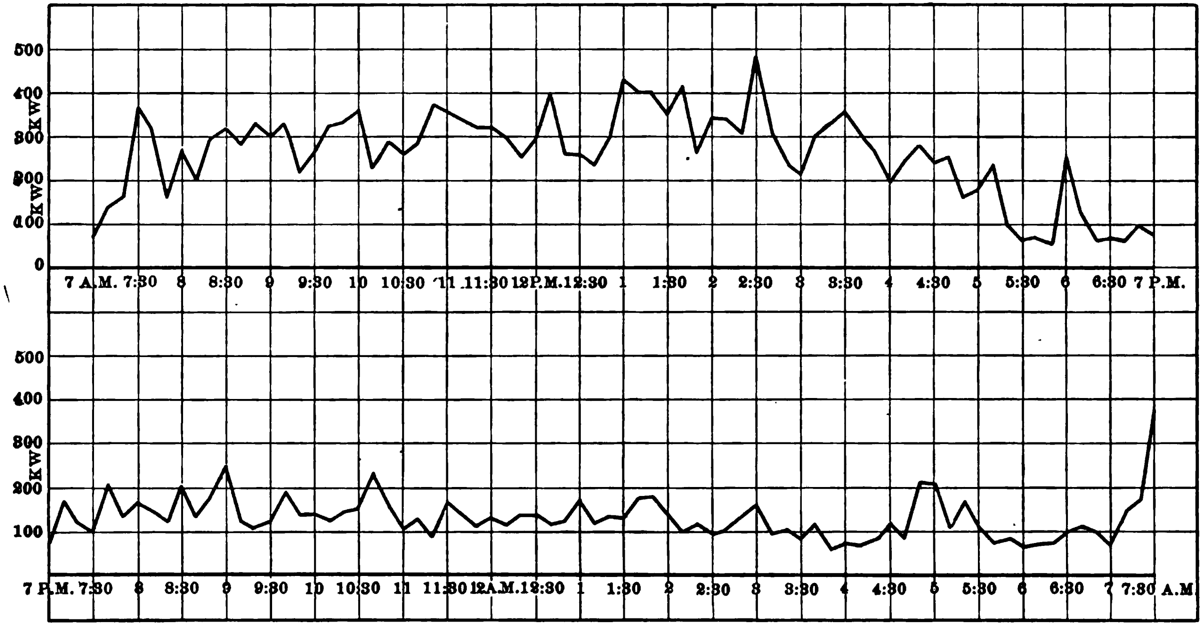


FIG. 2. TYPICAL 24-HOUR LOAD CURVE FOR ISOLATED COAL MINE PLANT

5-minute integrated peaks. It was further found in these 56 mines that the average 5-minute integrated peak load was only 60 per cent of the installed capacity. This was partly due to the installation of reserve in each isolated plant, but, generally speaking, is principally due to a lack of knowledge as to actual requirements and consequently high guessing as to capacity.

The average plant cost was found to be $80 per kw-hr. installed, reference to which cost will be made later on.

A careful test of ten mines in Ohio, having an average output of 21,500 tons each per month with an isolated power plant at each, showed an average cost of power of 2.553 cents per kw-hr. The average load factor for 24 hours on working days was 32 per cent, but the average number of days worked was only 15.5 per month, resulting in a 30-day load factor of 22.5 per cent. This load factor is again based upon the average kw-hr. consumption divided by the integrated 5-minute peak, which in this case averaged 310 kilowatts.

The average power per ton mined was 2.3 kw-hr., but in this case the fans and the main pumps were driven by steam. The estimated power consumption with complete electrification was 3.3 kw-hr. per ton. In the consideration of the question of supplying central station power to these mines, it was necessary to figure on disposing of the old apparatus on an unfavorable basis and determining the amount of new apparatus that would be necessary in order to use central station power. In this case a salvage of 10 per cent of the estimated cost of the isolated plant was all that was allowed as a possible recovery for it. The sub-station apparatus for handling the central station power was figured at market prices and it was then determined that the rate for central station power (without service charge) to offset the present cost should be 1.733 cents per kw-hr.

A test on five coal mines in Virginia showed a power consumption of 2.65 kw-hr. per ton mined with a maximum momentary peak per 1000 tons per day output varying from 267 to 378 kilowatts. The average day (10 hours) load per 1000 tons output varied from 157 to 207 kilowatts and the average 24-hour load on working days (10 hours) varied in different mines from 119 to 117 kilowatts. The combined load factor for 24 hours for all five of these mines was shown to be 28.8 per cent, which is high, owing to heavy fan loads with improper speed regulation, which involved wasteful methods. From these data it might be determined that a 200 kilowatt substation unit per 1000 tons output in a 10-hour working day would be a reasonably safe and satisfactory unit to install for ordinary mine service.

It must be thoroughly understood that conditions vary widely and it is not safe to assume exactly similar conditions as applying to mines even in the same locality, owing to differences in the character of the coal, the method of mine development, the physical characteristics of the locality with reference to drainage and ventilating, and other similar conditions involved in coal production. The results given herein will serve to show the general characteristics of coal mine loads in bituminous mines. It is apparent from recent papers presented on this subject (H. M. Warren and H. S. Biesecker, A. I. E. E., April, 1913; C. W. Beers, A. I. E. E., April, 1913) that the characteristics of anthracite coal mine loads differ materially, owing, probably, to a greater pumping load, resulting in a higher load factor in most cases.

A typical case as to results in mining operation with central-station power is cited in a shaft operation in the middle West, where practically all of the mechanical operations were electrified, including the replacing of a steam hoist with an electric hoist. In 1911, with steam operation, this mine produced 82,000 tons of coal and used 1860 tons, or 2.3 per cent, for fuel with a value of $1,800. In 1912 with electrical operation, including the hoist, the production was 105,000 tons with a power bill of $2,362, or 2.24 per cent of the average value of the coal hoisted. It is evident from this that the power bill only equaled the normal value of the fuel used in steam operation with a complete saving of the labor of firing the boilers and a very material reduction in the fixed charges on the increased cost of power plants over the substation equipment. We are led to believe that the power rate paid in this case was entirely satisfactory to the power company.

Granting that the use of central station power in coal mines is attractive to both mine and central station operators, it would appear that but little more is to be said. There remains, however, a legitimate discussion of ways and means of securing this business as well as a discussion of the elements entering into the question from both mine operators' and central station operators' points of view.

When first approached on the subject, the average mine operator is skeptical as to the ability of the power company to deliver power at a lower value than he himself can generate it. He is also skeptical in regard to the continuity of service from a long transmission line and is further afraid that during labor disturbances at the mine the line transmitting power will be more liable to vicious attack on the part of strikers than would be a power plant close to his operations. These objections, if properly handled can all be overcome in the end and in most cases a satisfactory conclusion reached.

The representative of the power company must have a more or less thorough working knowledge of coal mining operations and must comprehend the elements of cost entering into the matter of coal production, in order to make the mine operator see the ultimate result of his use of central station power. This point cannot be emphasized too strongly, as it has been the observation of many that the central station power solicitor too often has in mind the rate per kw-hr. rather than the ultimate cost per unit of production of the commodity involved in the transaction. The mine operator naturally associates lighting rates with the question of purchased power and cannot at first see why a power load can be sold profitably at a materially reduced rate.

This in turn shows the necessity of making the prospective customer understand more fully the conditions of operating central station plants in order that he may have confidence in the ability of the central station to continue for a long period to furnish power at the low rates (as they appear to him) which have been quoted him for power.

One of the first stumbling blocks encountered is that of fixed charge. This does not appeal to the mine operator as a reasonable element. In the case of the 56 plants in West Virginia to which reference has been made it was found that the average cost of the plants as built was approximately $80 per kilowatt and the mine operators appreciated that 15 per cent was a very reasonable charge for interest, depreciation and amortization. It was then shown that these plants actually involve a fixed charge of $12.00 per annum per kilowatt installed or $1.00 per month, corresponding to a similar charge on the part of the central station operators. It was further shown that this amounted to $1.66 per month fixed charge on the basis of the 5-minute integrated peak load, which, as previously stated, was 60 per cent of the plant capacity. Following this line of reasoning the power company had very little difficulty in persuading the customer that, with a comparatively low rate for the measured power, it was perfectly reasonable to make a charge of $1.00 per month as a fixed charge, based on the 5-minute integrated peak load in most cases and upon 10 and 15 minute integrated peak loads in other cases, where the amount of power and the characteristics of the load seemed to justify these values.

It can reasonably be shown that the cost of power is made up of a fixed element and a variable element and that the most equitable manner of establishing a charge for power is one that takes both elements into consideration. It is comparatively easy to show that the fixed element is based logically upon demand and the variable element upon total consumption.

It is quite natural that central stations should object to a promiscuous quotation of rates, but comparatively few of them appreciate the free exchange of information among coal mining operators, so that in the end the question of secrecy regarding contract rates is not generally justified. It is, on the other hand, fully appreciated that exact rates are dependent upon local conditions and it is not within the province of this paper to discuss other than the general features influencing this class of business.

It is generally conceded that the fixed charge should be a function of the maximum demand rather than that of the connected load, as the latter would tend to reduce the amount of reserve equipment installed and would also encourage the figuring of apparatus too small for the application, thus increasing the risk to safe operation by the use of electricity. Basing the fixed charge on rating of connected apparatus always involves a discussion of the relative ratings of intermittent and continuous apparatus.

Some maintain that a load sustained for a given period, say one minute, as determined by a graphic instrument, is the proper basis for a fixed charge. It is the writer's opinion that an average load as determined by an integrating wattmeter for a period of say five minutes should be used on the smaller installations, when necessary extending this to integrated peaks of longer duration, depending upon the load factor and general characteristics of the load. This opinion is based on the fact that in this service there are few sustained peaks of long duration, and at the same time this method gives the central station a good average protection.

Messrs. Sykes and Bright in their paper before the April, 1913, meeting of the A. I. E. E. at Pittsburgh, give valuable data on this subject in which they show that the 5-minute integrated peak works out to be only 6½ per cent higher than the 15-minute peak and a 10-minute peak only 4 per cent higher than the 15-minute peak. They also show in curves, Fig. 3, a comparison of 5, 10 and 15-minute combined peaks on six mines tested simultaneously. Referring to the combined 5-minute peak curves of the six mines as regards diversity, note that the total 5-minute peak curve is only 68 per cent of the sum of the individual 5-minute peaks of the different mines. It should be stated in this case that much of the outside machinery at these mines was steam driven when the tests were made and after complete electrification they should show a higher night load and a better load factor.

It will be interesting to note the following basis of contract offered by a large power company in West Virginia after going over the requirements of a large number of prospects. Fixed charge $1.00 net per month on integrated peak loads with definite circuit breaker setting to protect against peak loads as follows: 50 to 300-kilowatt 5-minute peaks, 100 per cent overload; 300 to 500-kilowatt 10-minute peaks, 75 per cent overload; 500-kilowatt and up 15-minute peaks, 50 per cent overload. A low rate per kilowatt-hour was established and generally made known with a sliding scale of discounts ranging from 2½ to 55 per cent maximum, depending on the total consumption of power per month.

Owing to the fact that a large proportion of the power has to be converted to direct current, the question of power factor does not usually present difficulties, particularly if a synchronous type of converting apparatus is used. In most cases the direct-current distribution is such as to make over-compounding necessary and this is practically obtainable only by the use of motor-generator sets. The ratio of average to maximum load on the direct-current circuit is such as will usually allow a synchronous motor driving the set to operate with slightly leading power-factor to correct in a measure for the lower power-factor on pumps fans and other drive where induction motors are applicable.

Aside from dictating the type of apparatus to be used, no satisfactory system of taking care of power-factor seems to have been introduced. It is possible that some form of meter will eventually be devised which will automatically compensate for

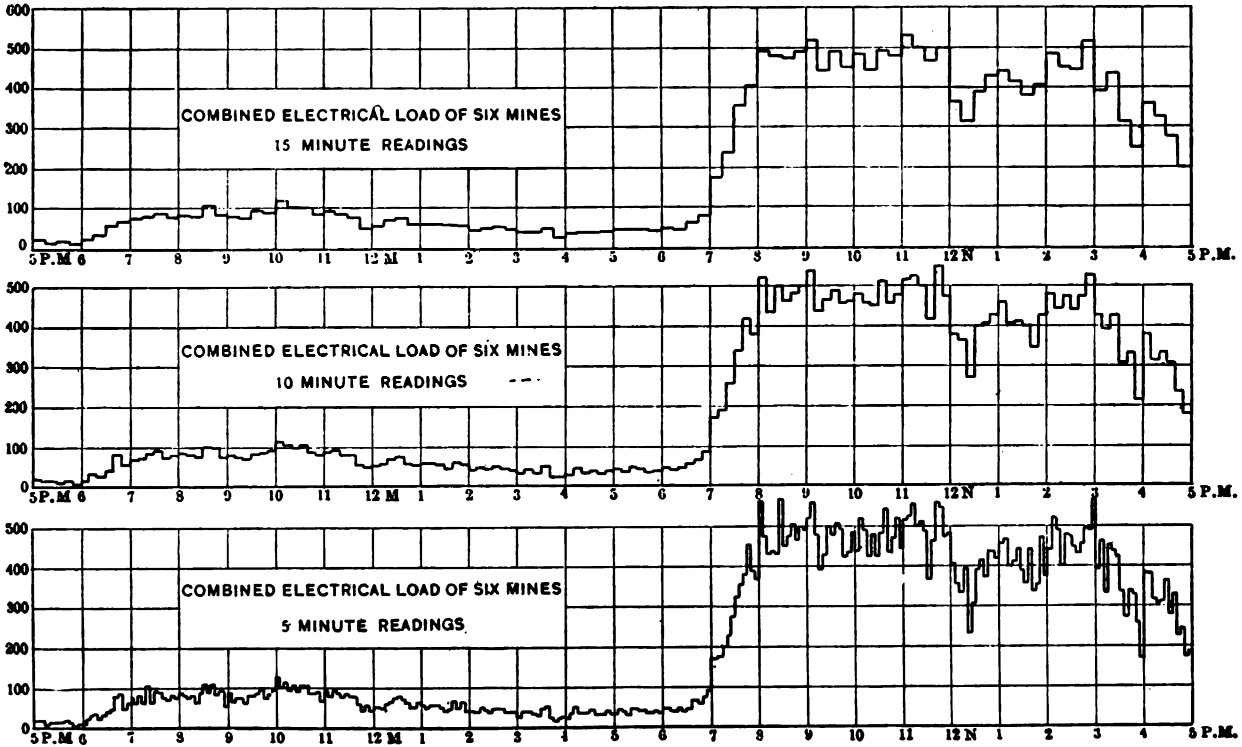


FIG. 3. COMPARATIVE CURVES OF COMBINED PEAKS ON SIX MINES TESTED SIMULTANEOUSLY

high power factor and penalize for low power factor, in which case a consistent effort would be made by the purchaser of power to maintain a high power factor.

Messrs. Sykes and Bright sum up suggestions for an ideal power contract for mines, based upon the following: "(a) Fixed charge, depending upon the integrated peak loads for a reasonable period so that it will represent approximately the equipment required to carry the consumers' load.

"(b) In addition to this a flat rate per kilowatt-hour based on operating cost, taking into consideration the amount of power used and allowing a graduated discount to give large consumers a lower rate.

"(c) If power factor is a consideration, a reasonable limit should be set, lower power factor being penalized by increasing the rate per kilowatt and a reduction in rate granted if higher power factor is used."

In general where the use of central station power is a new thing among the coal operators it will be necessary to show that the ultimate cost of producing a given tonnage of coal will be equal on a lower investment or less on an equal investment, and the central station should adopt a fairly liberal policy in regard to any points upon which there may be doubt, in order to establish confidence in the service.

It should be borne in mind that the burden of demonstration rests largely with the central station, and if the central station operator has familiarized himself thoroughly with the mining operations it is usually not difficult to demonstrate his case.

It is customary to deliver the power at a given voltage, say 2200 or 6600 volts, and for the consumer to purchase the necessary substation apparatus; the power to be measured at the delivered voltage.

In new development, another factor decidedly in favor of central station power is the reduced investment on the part of the mine operator in substation apparatus as against an isolated generating station, thus reducing the total initial investment or allowing the operator to invest his money to a greater extent in the mining operation. In a number of instances the central station has found it desirable even to make the investment for the substation, allowing the mine operator to pay for it in installments with a reasonable interest, or to retain the substation equipment and allow the mine operator to pay a reasonable interest and depreciation on the investment A notable case of this kind is a contract made by the Centerville Light & Traction Co. of Centerville, Iowa, in which it is arranging to furnish coal mines some eight miles from the central station with power, transmitting it at 13,200 volts, installing the necessary step-down transformers and motor-generator sets at 2200 volts, the current being metered at 2200 volts before it enters the motor-generator set. The coal companies furnish the building and the power company furnishes the apparatus and charges a rental of 15 per cent per year for the use of this with an option to purchase at any time less the amount they have paid as depreciation, which is figured at 9 per cent. The power company constructs the transmission line to the coal mines upon an agreement with the coal companies to a minimum bill per year. This typifies a progressive policy which is being followed by other companies as well on new installations and on installations requiring the abandoning of old apparatus already installed, which in some cases is purchased by the power company on a reasonable second-hand basis.

This field of activity for central station service offers to those stationed in close proximity to coal mines a most attractive market for power, especially where combined with a general lighting and power load, and merits a very careful study to determine all of the factors entering into the question. The writer would emphasize particularly the necessity of understanding the mine operators' conditions and of then dealing frankly and openly with the mine owners so that there can be no misunderstanding as to power rates or the elements entering into them.

Much delay has been experienced by reason of a complicated system of charges which could not be comprehended by the mine operators to whom full explanation of all of the elements had not been made. The simpler the form of contract offered and the plainer the rate and basis of charges are made, the easier it will be to develop the power business in dealing with coal mine operators, since, as previously stated, it is difficult for the average operator to understand how it is possible for the central station to pay freight on the coal and sell him the power derived therefrom at a lower cost than it is possible for him to produce it at the mine.

DISCUSSION.

Mr. W. H. Thomson, Jr., Des Moines, Iowa: I would like to inquire whether Mr. Thomas has had information as to any action the Mine Commissions of other States have taken regarding the installation of additional reserves in mines. They are doing it in Iowa. If these reserves are required, how are they handled?

Mr. D. B. Rushmore, Schenectady: Two very interesting facts have recently come out in connection with selling electrical output to coal mines, due to the fact that in the Pocahontas field, where the coal is available for sale, it has been found possible to furnish electric power generated by water in the district to regulate the fans in the coal mines. There has recently been introduced a new method of control, by which an induction motor is used, which converts the energy heretofore lost in resistance, and results in a very high degree of efficiency,

Mr. Thomas: I might say, Mr. Chairman, that the question of providing reserve for fans has not yet come up, so far as I know. In Pennsylvania mines, with shaft operation, where the men have had to climb ladders to the surface, there has been a ruling in one case called to my attention, where they have insisted upon a reserve hoist of some kind, so that in case of failure of power the miners would not be left in the mine without any means of getting out.

The Chairman: Will there be any further discussion on this paper? If not, we will have the next number, the Report of the Committee on Steam Heating, Mr. S. M. Bushnell, of Chicago, Chairman.

REPORT OF THE COMMITTEE ON STEAM HEATING

In the report of the Steam Heating Committee to the Seattle Convention last June, there were included a number of replies from heating companies, giving prices charged for steam service, and also stating whether or not the business was found to be profitable. The replies seemed to show that about one-half the companies considered the business profitable.

In view of the fact that in some cases the companies which had a low scale of prices thought the business profitable, while others with a high scale found it unprofitable, it was thought by the Committee this year that it might be well to go a little further into this question in an attempt to analyze, in a somewhat general way, the conditions which determine the profitable operation of a steam-heating plant. With this in mind, the companies that replied last year were asked to give information on the following items:

(1) Cost of steam per 1000 lb., delivered at the boiler header; the cost to exclude investment charges.

(2) Number of lineal feet of underground mains of various sizes.

(3) Number of pounds of steam sold during the 12 months of 1911; or, number of cubic feet of volume connected; or, number of square feet of radiation connected.

(4) Investment in the distributing system.

(5) Gross steam income for the 12 months of 1911.

Replies were received from over 30 companies, or about one-half the number addressed. These replies show a very wide range of conditions. The income from the sale of steam was in some cases relatively high, in others relatively low. In one case the income for the year was more than the investment, while in another it was only 10 per cent of the investment, the most frequent proportion being one to three.

The cost per foot of lines also showed a wide range, varying from an average cost of less than $1.00 per running foot, to a cost of ten times that amount.

There was an equally wide diversity in the replies as to the cost of steam per 1000 lb. delivered to the boiler header, the figures varying from a very low cost to more than 50 cents per 1000 lb. It is needless to say that, in view of the wide range of these replies, it would be very easy to reach an erroneous conclusion in regard to the profitableness or nonprofitableness of steam heating.

The more the Committee studied these returns, the more it was inclined to believe it impossible to deduce any formula which will determine in a given case whether a steam plant is advisable or not. Each city presents its own problem, which must be carefully studied before the central heating investment is made.

Where a non-condensing central station for supplying electric light and power already exists, it is often practicable to make additional profit by the installation in the streets of a system of steam mains, using the exhaust from the engines as a partial supply for the heating system. Before such a system is installed, however, the situation must be carefully gone over by an experienced engineer, the character of the soil investigated, and a careful estimate made both as to the amount of business which could probably be secured and the investment necessary for pipe lines, meters, etc. In many cities a superficial investigation would indicate a very profitable field for the installation of a central heating system, while a more careful survey would prove the reverse.

In a city where hard coal for the householder sells at from $6.00 to $7.00 per ton, and a central station could be located along the railroad tracks where soft coal could be procured at a cost of from $1.50 to $1.75 per ton, there would seem to be an opportunity to sell steam to the small consumer and make a fair margin of profit on the transaction. However, many a central station has embarked in the steam heating industry on account of the argument based on the comparative prices of coal, only to find that important elements had been overlooked which offset this most obvious advantage.

For example: The investment cost of a central heating installation, while at all times high, is in some cities practically prohibitive. There are various disadvantages in installing a steam-heating system, such as:

(a) Necessity for draining pipes.

(b) Necessity of allowing for expansion and contraction in pipes.

(c) The constant danger of leaks.

(d) Difficulty of securing practical and durable heating insulation.

(e) The rapid deterioration of piping used for this purpose.

(f) And obstacles encountered in city streets already occupied by pipes and conduits for various other purposes.

These are a few of the items which conspire to make the fixed charges of a heating company offset the initial economy in steam production.

Sometimes a central station which has had such an experience will take an extreme view of the situation and condemn the entire heating proposition as impracticable, uneconomical and unprofitable. In the judgment of the Committee, this is an extreme position, and one not warranted by the facts. We have agreed, however, that caution is required in the installation of a heating system.

One error often made by steam-heating companies consists in extending their piping system too far. A given town may have a small district where, by the investment of from $10,000 to $15,000 in pipe lines, a remunerative income may be secured. In this same town a company will spend $100,000 in extending its lines to territory which will produce very little business. The result is that the company not only has a large investment on which it is unable to earn returns, but has also increased its operating expenses by heating a large system of underground pipes in order to furnish a very limited amount of steam. Steam-heating companies must have the courage frequently to say *no* to would-be customers, even if it involves friction at the time.

Doubtless there are some heating plants now in operation where the owners would save money by simply abandoning the field, instead of sending good money after bad; and there are others, where, in spite of the fact that the plant has been and will continue to be operated at a loss, it would not be good policy to get out of the heating business and abandon the field to others, who might use this fact as a means for securing franchises for heating, lighting and power.

Another item which should not be overlooked is the fact that many companies are charging too low a rate for their heating service. Several companies in the past year have tried the experiment of raising their rates and have found that very few customers were lost as a result. On the other hand, the effect of raising rates has been a more careful use of steam on the part of customers, with the result that frequently bills for steam remain at about the same figure, while the output of steam is less, and, therefore, the operating cost is reduced. The Committee, therefore, feels inclined to take a somewhat optimistic view of the situation and believes that as we increase our information on the various elements which enter into the heating business, we shall gradually achieve a more satisfactory showing on a dollars-and-cents basis.

At all events, whether profitable or unprofitable, there is no question that the central-station steam-heating business is now with us and has come to stay, and the Committee has, accordingly, collected some data, which will, perhaps, be of service to central-station companies, both in estimating the cost of steam service and in figuring the items which affect the costs in independent isolated plants.

DATA ON COST OF STEAM SERVICE

In the report of the Committee last year, there were given several formulæ which have been used by heating companies in estimating the cost of heating buildings during the winter season, but the matter of data on steam for special purposes was left untouched. The Power Committee of this Association has, from year to year, been collecting some very valuable data on the average cost of electric power requirements for various classes of machinery, and it has seemed to the Steam Heating Committee that it would be well to inaugurate the practice of securing as much reliable data as possible on the average cost of supplying steam for various classes of service.

At the end of the report under Exhibit A will be found a report on steam consumption in a tannery. It is, of course, understood that all tanneries are not alike, but this particular report gives the consumption of steam in the individual classes of apparatus required in the various processes, so that it is fair to assume that a man figuring on a similar installation will be able to get some idea of the probable steam requirements of a new installation from the data here given. This report is contributed by Mr. J. L. Hecht, a member of the Committee.

Under Exhibit B will be found a table, showing data collected in Boston, New York, Detroit and Chicago, on the use of steam in special warming and cooking apparatus.

POPULARIZING DISTRICT HEATING

Another subject discussed by the Committee was the question of making district heating more popular and satisfactory to customers. Mr. Oehlmann, a member of the Committee, contributed an article on this subject, of which the following is an abstract:

The question of popularizing district heating is one that requires considerable thought. Revenue must be received during 7½ months, which will provide returns on a 12-month investment. Generally speaking, every business man would prefer to use heat from the central plant as against private or isolated plants, at even cost. In many cases merchants or owners of buildings are not equipped so that they can have their own plants, and it is necessary for them to depend on the central-station company for service. These people are often the hardest class to handle because they believe the heating company realizes that they are helpless and treats them as it sees fit.

The quickest and best way of popularizing the heating business is to give good service. This does not mean that with good service one can secure an exorbitant price for steam, but it is essential that there be good service from the operating point of view.

He says, further, that it is often the case that steam rates are not at fault when complaint is made of high bills. They are caused by the fact that we have not educated our customers to use steam as economically as they would if their own firemen were operating the boilers. High bills caused by an extravagant use of steam are the greatest drawbacks to popularizing central-station heating. This, of course, refers to steam sold on the meter basis. Accordingly, popularizing the district-heating business consists largely in educating a customer to the economical use of heat. This is a point which has been neglected by steam-heating companies in past years. In fact, they have encouraged waste in many instances by quoting flat rates for continued service, disregarding the possibilities for economy on the part of the customer.

Petty complaints of leaky or air-bound radiators, or traps that are air-bound or stuck, are not handled at all by most heating companies. The customer is advised to call up some steamfitter and have him remedy the trouble.

Mr. Oehlmann suggests that while it is not a good plan to ask the customer to pay for the main extensions he should be required to pay for service from the main to his building.

He advises that steam-heating companies have an engineer on heating who will assist the prospective customer who is putting up a building to design his heating system in an economical manner.

He also suggests that where heating is sold on a meter basis the heating company should, so far as possible, insist on making contracts directly with the user and not with the owner of the building. Where the owner leases his building to tenants and the leases include heat, the owner is dependent entirely upon the tenant for economy, and, as a rule, the tenant is inclined to forget the interests of his landlord. In many cases where the landlord leases his building and the lease includes heat, the heat wasted is three or four times that where the tenant himself pays for the steam. The central-station company, therefore, should help in establishing the custom of dealing, so far as practicable, directly with the tenant for his steam service.

When a prospective customer comes for advice as to his installation it is then generally easy to design the installation so that every tenant may have his own meter and be obliged to make his own contract with the heating company. This, of course, means to the owner of the building an additional cost for separate pipes, traps, etc., but it soon pays for itself by relieving the owner from paying for heat when stores are not in use, and for other losses caused by the waste of steam.

HOT WATER VERSUS STEAM FOR DISTRICT HEATING

Another subject discussed by the Committee was the question of hot water versus steam for heating. As there are various arguments in favor of both systems, the Committee does not feel inclined to give any definite recommendations in favor of either one or the other, but believes that in some cases a hot-water system might be right, while in others a steam-heating system would be more advantageous, depending upon conditions in the locality to be served.

Mr. Hecht, a member of the Committee, has submitted in condensed form some of the arguments in favor of the two systems. It might, therefore, be interesting to note just what these are, so that in a given case one can decide as to how much weight shall be assigned to each. The arguments in tabulated form are as follows:

STEAM	HOT WATER	THE ADVANTAGE FROM HEATING COMPANY'S SIDE IS IN FAVOR OF
(1) Single pipe line less expensive.	(1) Double pipe line.	Steam heating.
(2) a Meters practicable. Enable sales to be made on basis of quantity used.	(2) a Meters not practicable, therefore sales must be made on a flat rate.	Steam heating.
b Cost of installing and maintaining meters.	b No meter cost.	Hot-water heating.
(3) a Thermostats not required on metered systems unless customer wishes same for his own economy and comfort.	(3) a Thermostats required for reasons of economy since heat supplied is not measured.	Steam heating.
b No thermostat cost for heating company.	b Cost of installing and maintaining thermostats.	
(4) a Low pressure on mains and radiation.	(4) a Considerable pressure on mains and radiation.	Steam heating.
b Small leakage loss.	b Considerable leakage loss.	
(5) a No pumping equipment required.	(5) a Pumping equipment required.	Steam heating.
b No station heaters required.	b Heaters required in station.	Steam heating.
(6) Condensation lost.	(6) Condensation saved.	Hot-water heating.
(7) Radiation loss from higher temperature.	(7) Radiation loss from double pipes and larger piping.	Probably steam heating.
(8) Reducing valve frequently required on services.	(8) Reducing valve not required.	Hot-water heating.
(9) Quick regulation from station in case of fluctuation of outside temperature.	(9) Some time required to heat and circulate water.	Steam heating.

(10) Height of building which can be heated unlimited.	(10) Height of building which can be heated limited, due to static head.	Steam heating.
(11) Small liability to damage because of leakage in equipment.	(11) Liability to damage because of leakage of water due to higher pressure.	Steam heating.
(12) Steam can be adapted to hot-water installations by a hot-water heater, or to existing hot-air systems by indirect radiation.	(12) Hot water only can be used for hot-water installations.	Steam heating.
(13) Steam can be used for industrial and technical purposes.	(13) Hot water cannot be used for most technical purposes.	Steam heating.

FOR CUSTOMER'S CONSIDERATION. NOT OF DIRECT INTEREST TO THE HEATING COMPANY

STEAM	HOT WATER	THE ADVANTAGE FROM THE CUSTOMER'S SIDE IS IN FAVOR OF
(14) Higher temperature in radiation.	(14) Temperature in radiation more uniform. Does not drop so soon.	Hot-water heating.
(15) Cost of radiation installation less for steam.	(15) Cost of radiation installation more expensive.	Steam heating.
(16) By metered system could economize on consumption and cost.	(16) Usually a flat price based on radiation.	Steam heating.

PRICES FOR STEAM

The Committee took up for further consideration the matter of rates for district heating. In the case of steam-heating systems it seemed to be the unanimous opinion that meter rates should be used so far as possible, installing either the dump type or a revolving type of condensation meter for small customers. In the case of large customers, where steam is furnished at high pressure, it is frequently simpler to use a steam meter, as in this way the steam can be measured where it is sometimes impracticable or difficult to measure the returns.

While, theoretically, the two-rate system, or, in other words, a system based on the heating surface connected combined with the total number of pounds of steam used during the month, has much in its favor, such a system is more or less difficult to handle, especially if steam is used not only for heating the building, but also for heating water, for cooking and for technical purposes. Accordingly, it would seem that for small customers it is better to adhere strictly to the one-priced measured system, using a sliding scale of rates based on the amount of the meter readings.

An interesting variation of the two-rate metered system is that used by the Pacific Gas & Electric Co., which charges on a sliding scale, varying from $1.00 to 60 cents per 1000 lb. of condensation. This scale is graded to each customer in proportion to the number of square feet of radiating surface in his building. For instance, if a building has 200 sq. ft. of radiating surface, the price is $1:00 per 1000 lb. of condensation. A larger installation would secure a somewhat lower rate, and an installation of 800 sq. ft., or over, would secure a rate of 60 cents per 1000 lb.

It has been suggested that, in addition to the one-price metered system for small customers, a schedule of rates might be worked out for wholesale use in cases where the steam consumption runs from 500,000 to 1,000,000 lb., or over, per month, and where measurement is made by a steam meter of the St. John, General Electric, or similar type. In these types of meters a curve is drawn, showing the amount of steam used, and the height of this curve shows the maximum amount used at any one time. It would, therefore, be easy to establish a system of rates based on the maximum demand and on the total amount used, which would correspond to the wholesale system of rates for electricity used by some of the large central-station companies.

One of the companies has taken a large customer and figured out a scheme that works on this basis: The maximum steam used per hour varies from 7600 lb. per hour in January, down to 3000 lb. per hour in July, with an average monthly maximum for the year of about 5000 lb. per hour. The monthly consumption varies from about 4,000,000 lb. in January down to 1,700,000 lb. in July, with an average of about 2,650,000 lb. per month.

In order to arrive at our basis of primary charge, we will assume that the boiler plant represents an investment of $10,000, with fixed charges on this investment amounting to $1500 per year. On the basis of an average maximum of 5000 lb., this would give us $300 per year, or $25 per month, per 1000 lb. maximum. Assuming that office and general expense of operating the plant, including superintendence, metering of steam, etc., would amount to $900, we would have $180 per year per 1000 lb. of steam, or $15 per month. This would give us a total of $40 per month per 1000 lb. of steam as our primary charge.

In this particular plant the operating costs run about 35 cents per 1000 lb. If we combine these two costs, we would have an average monthly bill as follows:

2,650,000 pounds at $0.35 per thousand pounds......	$927.50
5000 pounds maximum at $40 per thousand pounds.	200.00
Total	$1,127.50

or an average of nearly $0.426 per 1000 lb.

Inasmuch as the operating costs would vary with the size of the plant, the price per 1000 lb. of steam should be on a sliding scale, based on the number of pounds used per month.

This system of rates might be of special value to those companies operating the block system of heating, where the boilers installed in one building furnish steam both for the building in which they are installed and for outside customers whose boiler plants are not used. This scheme of charging, however, can be used only in connection with curve-drawing meters.

In connection with the question of rates, the members of the Committee made some investigation as to the prices of coal in different localities in the United States and from the reports of different members of the Committee, showing prices for such centers as Boston, New York and Chicago, it is very evident that there has been a gradual increase in the price of coal, the increase during the past 5 years averaging from 10 to 15 per cent. Inasmuch as coal is the most important item in the cost of steam, companies are warranted in making a slight increase in the price of steam on the basis of the increased cost of coal.

USE OF WASTE HEAT FROM GAS AND OIL ENGINES FOR HEATING BUILDINGS

In the discussion at the Seattle Convention last June, some one inquired if the Committee had any information as to the use of exhaust from internal combustion engines for heating water so as to provide steam heat. At that time the Committee had made no investigation, but during the past year Mr. E. F. Tweedy, a member of the Committee from New York, has taken pains to make a considerable study of this subject, and his report is herewith repeated in full. The closing tabulation of his report sums up the whole matter, showing that heat available from gas and oil engines is only about 5 per cent of that from the exhaust of ordinary high-speed single-cylinder engines. The report is as follows:

"The growing importance of the internal-combustion engine as a prime mover, with the consequent use, either actual or proposed, of this type of engine for supplying the light and power requirements of buildings, makes pertinent the presentation of certain data bearing upon the possibility of utilizing the waste heat of engines of this type in heating the buildings in which such engines are installed. The subject is by no means a new one, for an attempt was made to utilize the waste heat of gas engines soon after this type of engine first assumed commercial importance, which was some 25 or more years ago.

Several facts have militated against the more extended use of this waste heat for building heating. One difficulty has been the serious corrosion of the heaters used for extracting the heat in the exhaust gases, by the sulphurous acid gas and moisture present in the exhaust. In certain later types of heaters, however, cast iron has been substituted for steel, with the result that this corrosive action has been considerably lessened.

On account of the high temperature of the exhaust gases—usually ranging from 600 to 1000 deg. fahr.—it is desirable to place the exhaust heater or boiler as near as possible to the exhaust outlet of the engine in order to reduce the length of exhaust piping. It is not practicable to lag the exhaust piping with heat-insulating material, as overheating of the engine would usually result; as a matter of fact, it would be desirable in most instances to water-jacket the exhaust piping between the engine and the heater.

Another reason for the very limited extent to which the heat in the exhaust and in the jacket water has been utilized for building heat is the comparatively small amount of heat available from these sources as compared with the amount present in the exhaust of a steam engine carrying a similar load.

Amount of Heat Available

In Fig. 1 curves are given showing the approximate input of heat to gas and oil engines per kw-hr. of output. In this figure curve A is derived from a test made upon a 75-hp. low-pressure oil engine, operating on solar fuel oil of 17,240 B.t.u. per lb. (high). The heat input per brake hp. at various loads have been multiplied by 1.5 to obtain the heat inputs per kw-hr. Curve B represents the average heat economy per kw-hr. for gas engines of various sizes, as given in a paper read by Mr. E. D. Dreyfus before the Pittsburgh Railway Club. Curve C is derived from a test made upon two Diesel engines. The points shown by circles are for a 300-hp. engine operating on fuel oil of 19,419 B.t.u. per lb. The points shown by crosses are for an engine of 225 hp. The heat inputs per brake hp. have been multiplied by 1.5 to give the heat inputs per kw-hr.

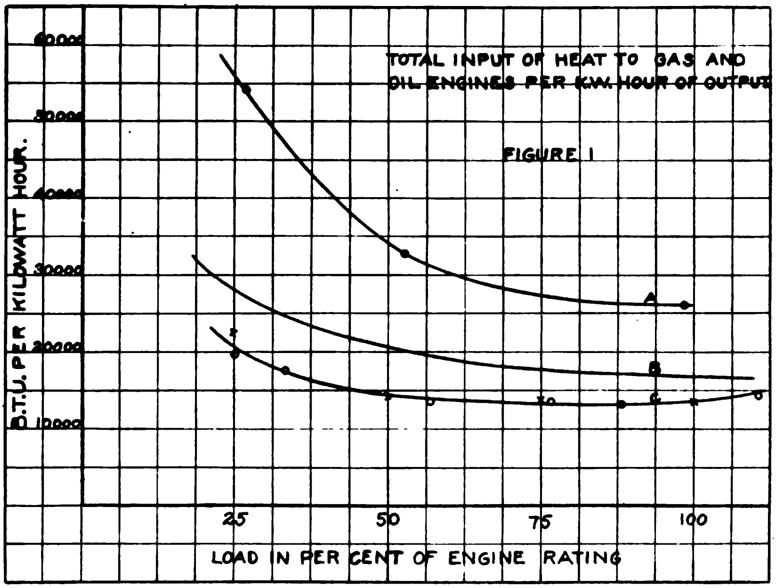


FIG. 1

Fig. 2 shows the distribution of heat in a 225-hp. Diesel oil engine, the input of heat to which, at various loads, is given in Fig. 1. From Fig. 1 it would appear that in the Diesel engine of medium size we may expect an average heat input from 50 to 100 per cent of rating, of about 13,500 B.t.u. per kw-hr. of output; while for the gas engine the average heat input through this range of load is probably in the neighborhood of 18,000 B.t.u. Individual engines of both types may, of course, vary considerably from these average figures. Fig. 2 shows that the heat represented in the exhaust, together with that lost in radiation and friction, averages about 50 per cent of the total heat input from one-half to full load for this particular Diesel engine. Probably a figure of 40 to 45 per cent for the heat in the exhaust alone would represent a fair average value for the Diesel engine in ordinary operation. The percentage of heat in the exhaust of the average gas engine may probably be taken at from 30 to 40 per cent of the total heat supplied to the engine. The relative amounts of heat carried away by the exhaust and by the jacket

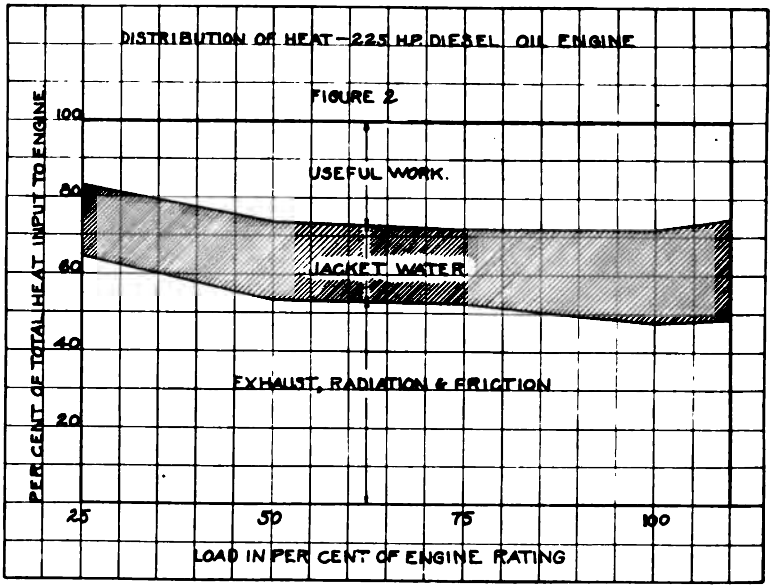


FIG. 2

water may, of course, vary to a considerable extent, in either type of engine, with the method of operation. Based upon the foregoing figures, we would have, with either of these two types of engines, in the neighborhood of 6000 B.t.u. available in the exhaust per kw-hr. of output.

The jacket water ordinarily carries away from 20 to 30 per cent of the total heat supplied to the Diesel engine and from 25 to 40 per cent of the total heat of the average gas engine. These percentage figures will, of course, vary to a considerable extent, according to the amount of cooling water supplied and according to its temperature.

Two distinct methods of utilizing the waste heat of gas and oil engines present themselves:

(1) Heating water by means of exhaust gas, either by
  (a) Raising the temperature of the water discharged by the jackets of the engine, or
  (b) Raising the temperature of other water, such as that in a closed hot water heating system, without making any use of the heat in the jacket water.

(2) Raising steam by means of the exhaust gases, using as boiler feed either
  (a) The jacket water, or
  (b) Other water, with no attempt to utilize the heat contained in the jacket water.

Where large quantities of hot water are required for industrial purposes (1) (a) affords a means of utilizing a large percentage of the waste heat of a gas or oil engine. When a building is to be heated by means of hot water, this method would not be practicable, and (1) (b) would be the method employed.

If it were desired to generate steam in small amounts for industrial purposes, the method shown under (2) (a) might be used, although it would entail considerable complication and materially increase the cost of installation. Moreover, the saving in heat would not be great, inasmuch as only a very small percentage of the jacket water may be evaporated by the heat in the exhaust gases. When steam is to be employed as the medium for heating a building, (2) (b) affords the most practical method of utilizing waste heat, and this system would, under ordinary circumstances, be the most desirable one to adopt.

Fig. 3, which is reproduced from an article in *Power* (issue of April 11, 1911), by Mr. E. D. Dreyfus, gives the results of a test upon an exhaust heater connected to a 200-hp. gas engine. The amount of heat reclaimed by this heater for the generation of steam was shown by this test to be in excess of 20 per cent of the heat supplied to the engine at all loads. This would be sufficient in amount to generate about 3 lb. of steam per kw-hr. at full load, and approximately 4 lb. per kw-hr. at 50 per cent of full load.

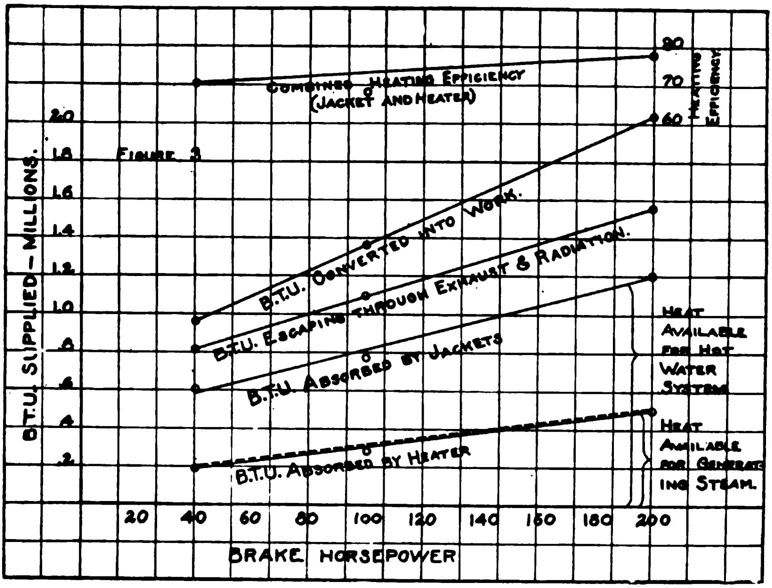


Fig. 3

The approximate pounds of steam per kw-hr. available in the exhaust of a steam engine and that available from heat in the exhaust of a gas or oil engine are as follows:

Simple automatic engine	60
Single-cylinder Corliss engine	42
Corliss non-condensing compound engine	33
Gas or oil engine, exhaust used for raising low-pressure steam	3

Accordingly, it will be seen how insignificant is the amount of steam that may be generated from the waste heat in the exhaust of the average internal combustion engine when compared with the amount of exhaust steam obtainable from the ordinary simple automatic engine generally used in isolated plant installations. This investigation naturally leads up to an investigation of the extent of the economy secured by the use for heating purposes of exhaust steam from engines in the ordinary isolated plant.

COMPARISON OF STEAM AND ELECTRIC LOAD CURVES IN LARGE BUILDINGS

In the report of the Committee last year reference was made to the comparative relation between the steam and electric loads in large buildings as affecting the question of using exhaust steam for heating, and a curve was given showing the average relation for the year between the general steam requirements of a large department store in Chicago and the steam which would be required if they generated their own electricity for light and power. This is a subject on which a great deal has been said and written, but on which, up to the present time, there have been very little accurate data secured. The reason for this is the fact that until within the last few years there were no large buildings using electricity from central-station service and steam on meter service which were provided with meters showing the amount of steam and electricity used at different periods of the day. As is well known, the General Electric and St. John steam meters are curve-drawing instruments showing not only the amount of steam used during the 24 hours, but also the amount of steam demand during any period of the day. In like manner, there are instruments showing by means of curves the electrical load of a building throughout the 24 hours.

The Committee this year decided to secure typical curves on different types of buildings, taken at different seasons of the year, but especially in the winter, so as to gain some actual information which would tend to remove from the speculative domain the subject of the relation between the heating requirements and the electric light and power requirements of typical buildings. On consultation with engineers, the Committee first assumed that the ordinary single-cylinder high-speed engine of the type most frequently used in large buildings, together with a direct-connected dynamo, would require, when operated under favorable conditions, an average of 50 lb. per kw-hr. It was found, however, in checking this figure with a number of tests made in New York, Chicago and other large cities, that, under average conditions, this efficiency could not be maintained. In view of the fact that during a large part of the 24 hours in the average plant the engines are not operating at full load, and after a few months of wear and tear there is some decrease in the efficiency of operation, 60 lb. of steam per kw-hr. come very much nearer the average result found in practice. Many of the tests show a steam consumption far in excess of this amount. Accordingly, in drawing these curves we have included the following:

(1) Curve showing present steam requirements of the building.

(2) Curve showing steam which would be required for the electricity actually consumed, based on a factor of 60 lb. per kw-hr.

In the case of some buildings where pumps or steam-driven elevators are installed, there is an additional curve showing the high-pressure steam required for these pumps, and a curve showing the total steam which would be available for exhaust from both the pumps and electric units, if they were installed. The curves show the actual steam required, and in the case of the curve showing steam available for exhaust, a slight deduction should be made on account of the condensation removed by steam and oil separators.

Diagram No. 1 gives a curve showing the steam and electrical requirements of a department store in Detroit on a typical winter day. This store is a brick building of 5 stories, having cubical contents of 1,545,000 cu. ft. and a connected steam radiation of over 10,000 sq. ft. There are also installed in the store a duplex steam pump, 18 in. by 12 in. and a house pump 12¼ in. by 10 in. The store is open for business from 8 A. M. until 5:30 P. M.

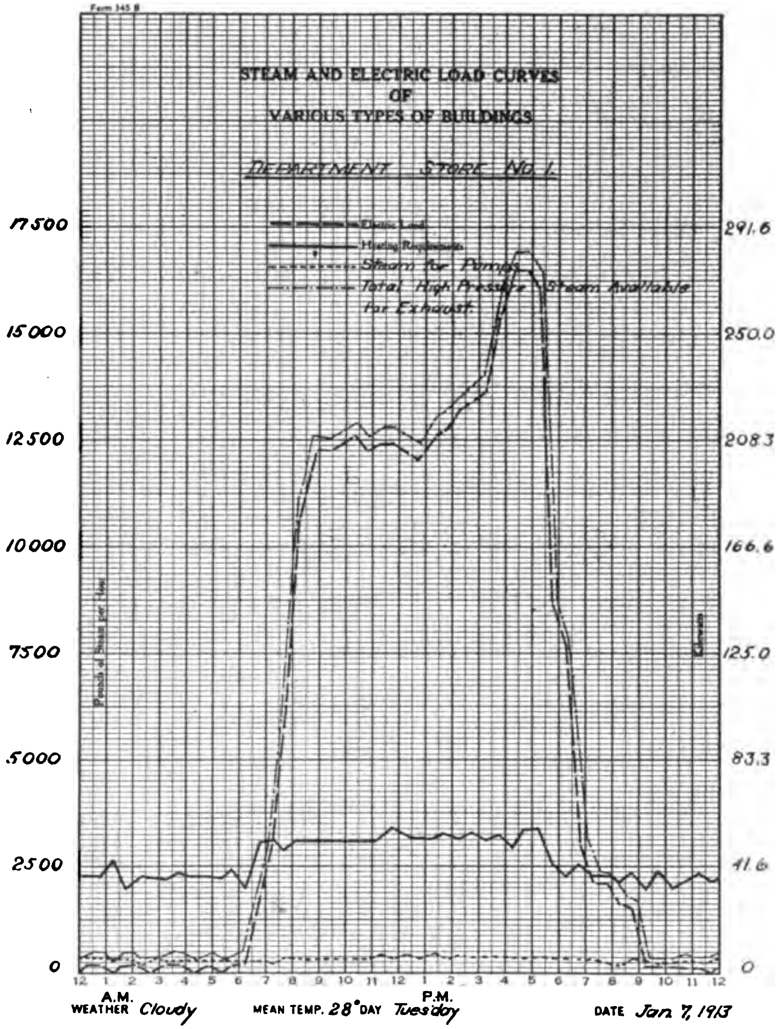


DIAGRAM 1

Diagram No. 2 represents the steam and electrical requirements during a summer day of a large department store in Chicago. This building is 8 stories in height and the cubical contents

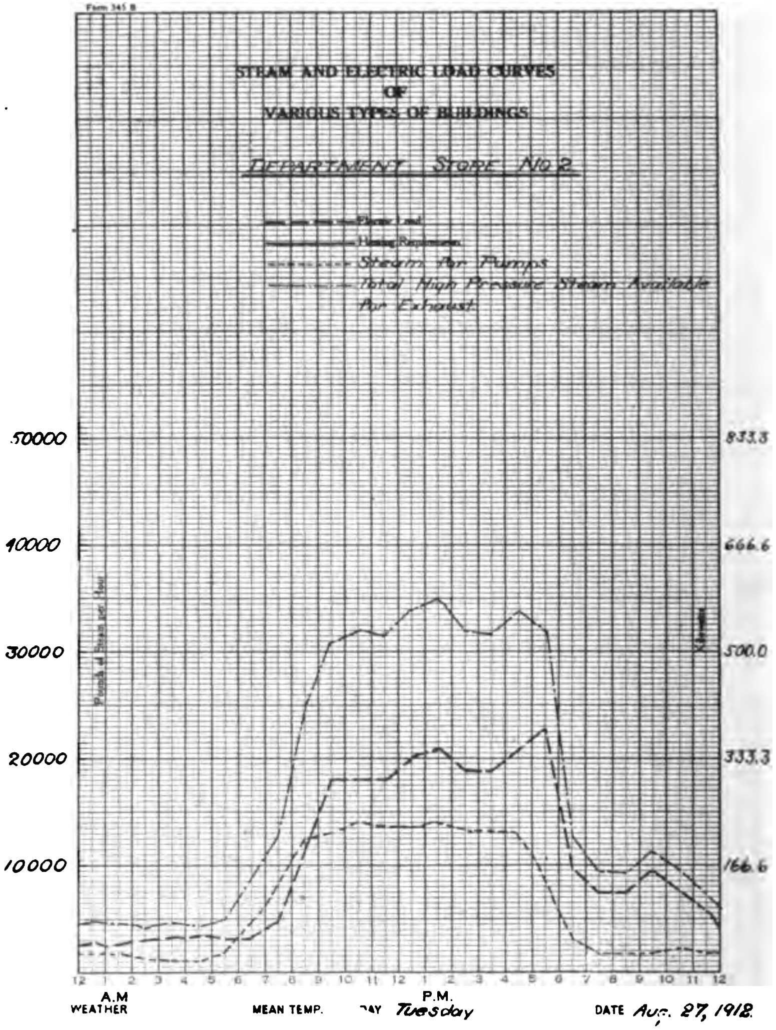


DIAGRAM 2

are approximately 7,800,000 cu. ft. In addition to radiation for both direct and indirect steam heating, there is required steam for 16 elevators and for boiler feed pumps.

Diagram No. 3 shows the steam and electrical requirements in the same department store during the holiday trade, in ordinary winter weather.

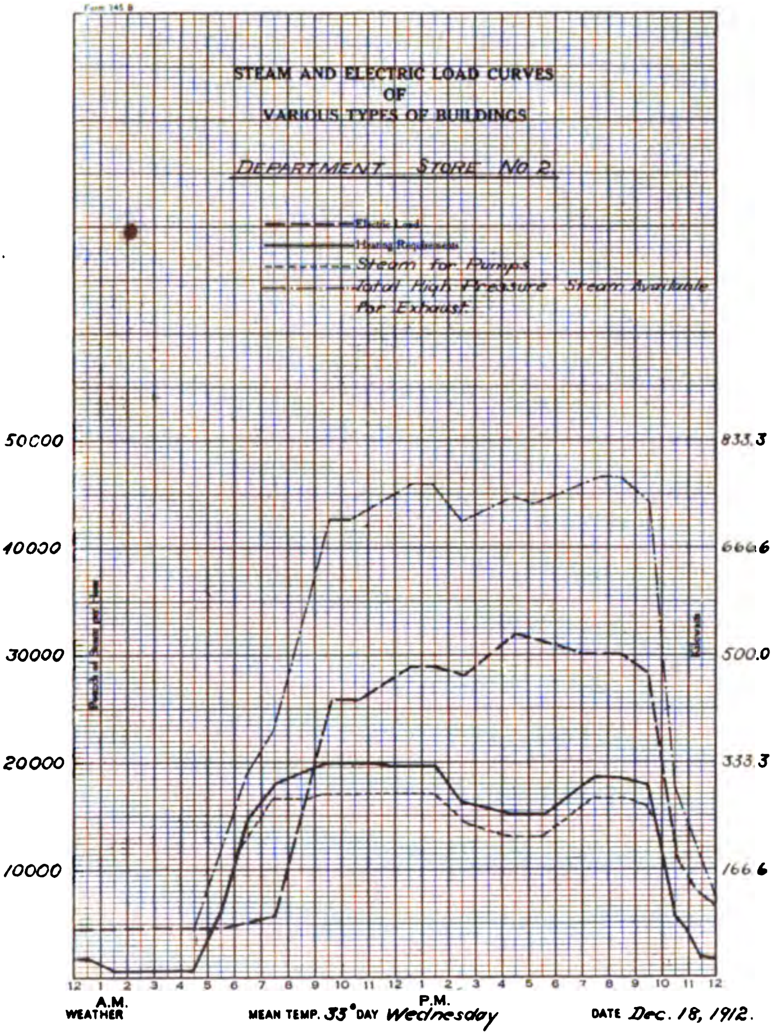


DIAGRAM 3

Diagram No. 4 shows the steam and electrical requirements in the same department store during severe winter weather.

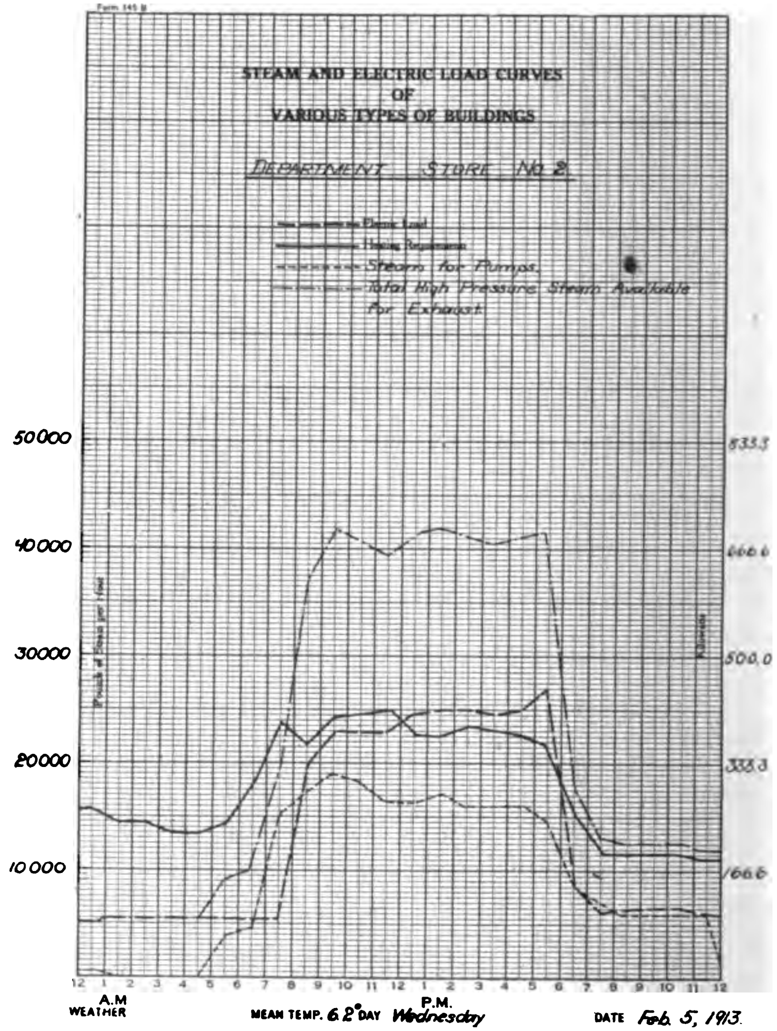


DIAGRAM 4

Diagram No. 5 shows the steam and electrical requirements in an office building in Detroit. This is an 8-story building of brick construction, having cubical contents of 565,000 cu. ft.

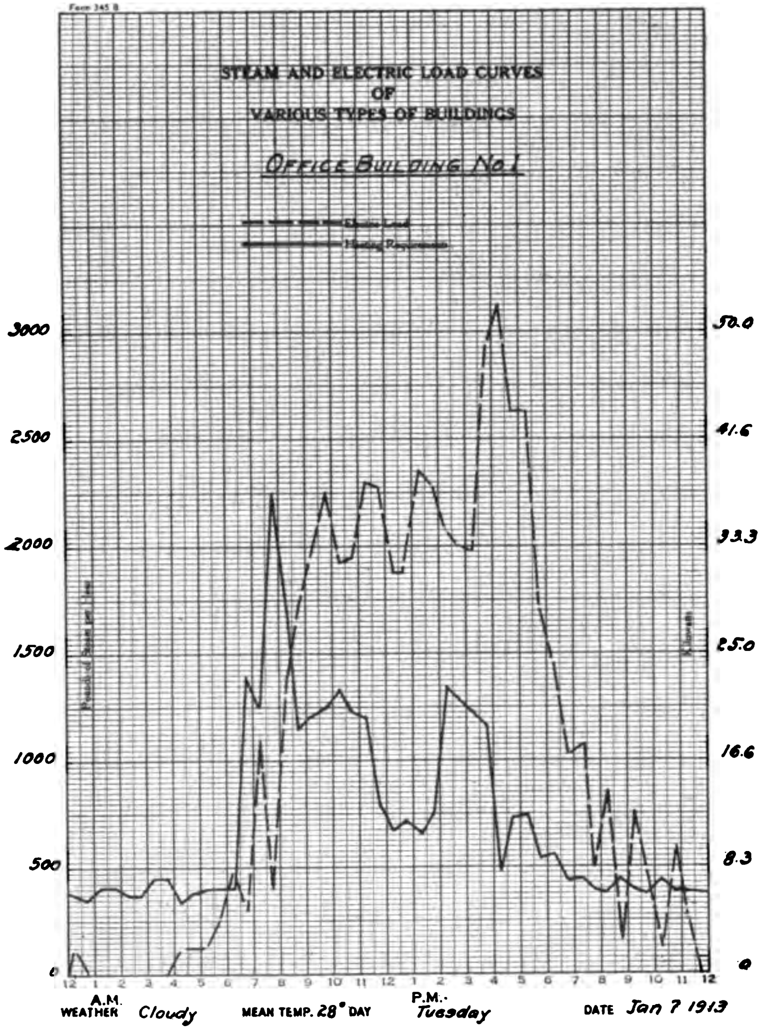


DIAGRAM 5

and connected steam radiation of 6600 sq. ft. It will be noted that the steam in this building is used for heating only.

Diagram No. 6 shows the steam and electrical load in an office building in New York. This is a 24-story building, having cubical contents of 6,500,000 cu. ft. and having 63,140 sq.

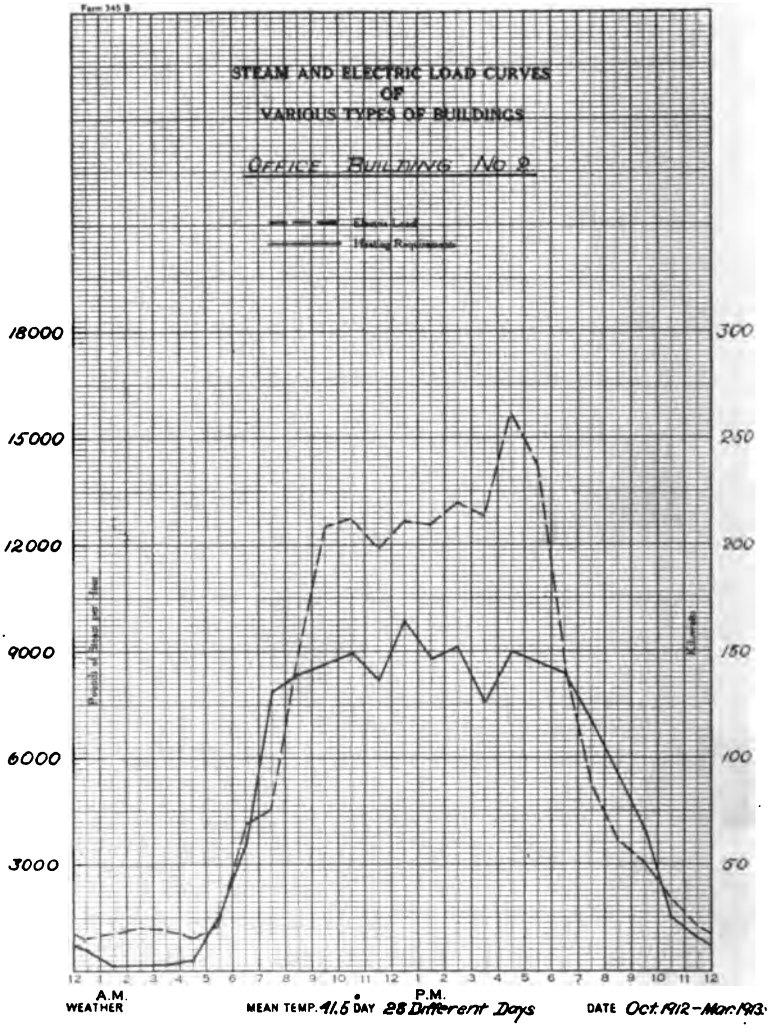


Diagram 6

ft. of radiation connected. It will be noted that this a composite curve, being the average of 28 typical winter days.

Diagram No. 7 shows a large office building in St. Paul. This is a steel and brick building, 16 stories high, having cubical contents of 1,907,800 cu. ft. and connected steam radiation of 19,500 sq. ft. It will be noted that this diagram shows conditions on a typical winter day in St. Paul; also that in this building steam is kept on all night in cold weather, thus giving a more even steam line than in some of the buildings.

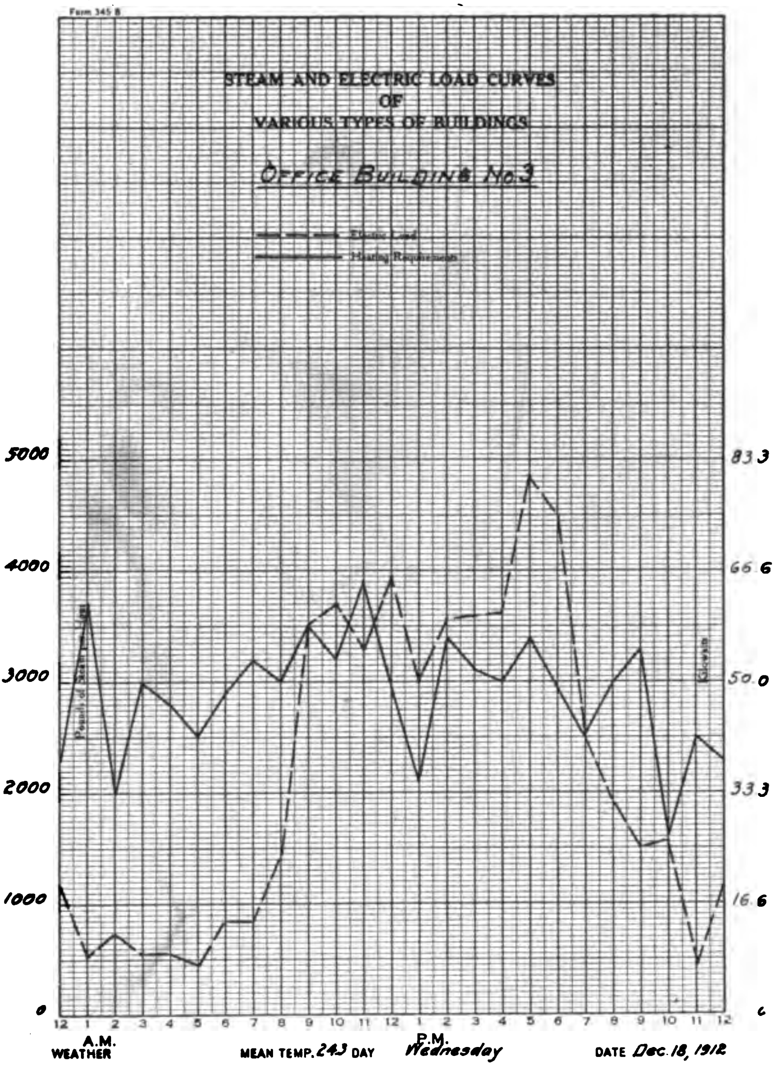


DIAGRAM 7

Diagram No. 8 represents the steam and electrical requirements in a theatre in Detroit. This is a 5-story building of brick construction, having cubical contents of 710,000 cu. ft. The steam for the office portion of this building, however, is not shown in the diagram, simply the steam and electrical requirements in the theatre. This curve shows that there are two performances each day in the theatre.

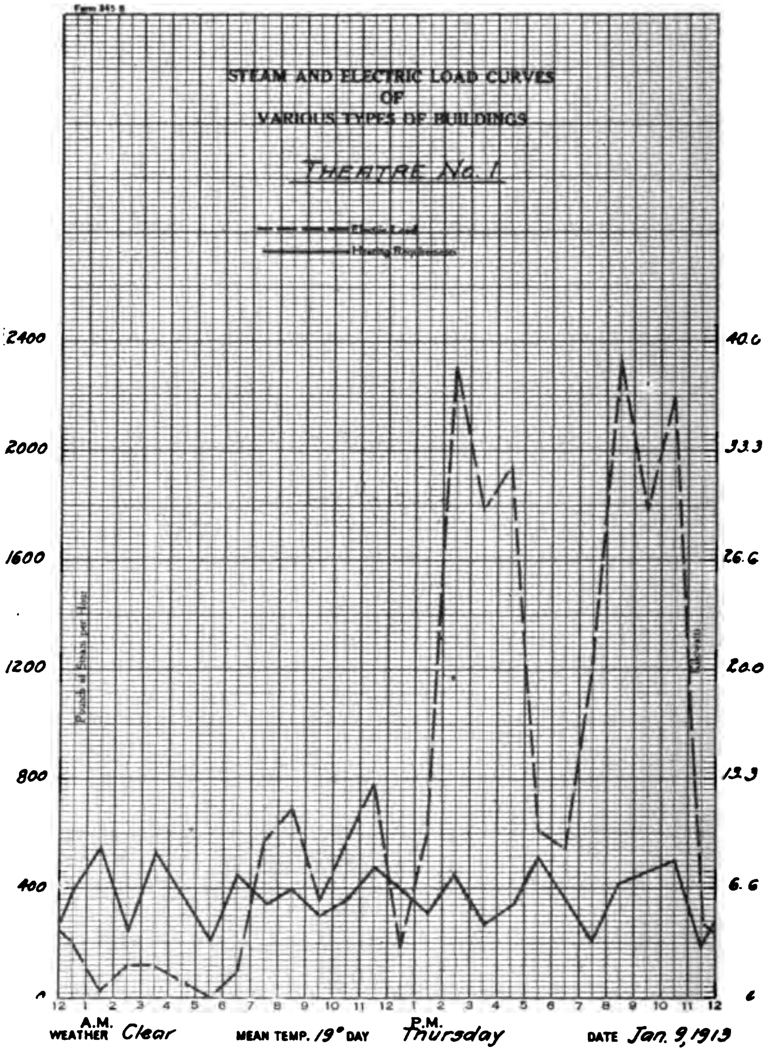


Diagram 8

Diagram No. 9 shows the steam and electrical load in another Detroit theatre. This building is brick, with a stone front, having cubical contents of 750,000 cu. ft. The steam for the office building is not shown in the diagram.

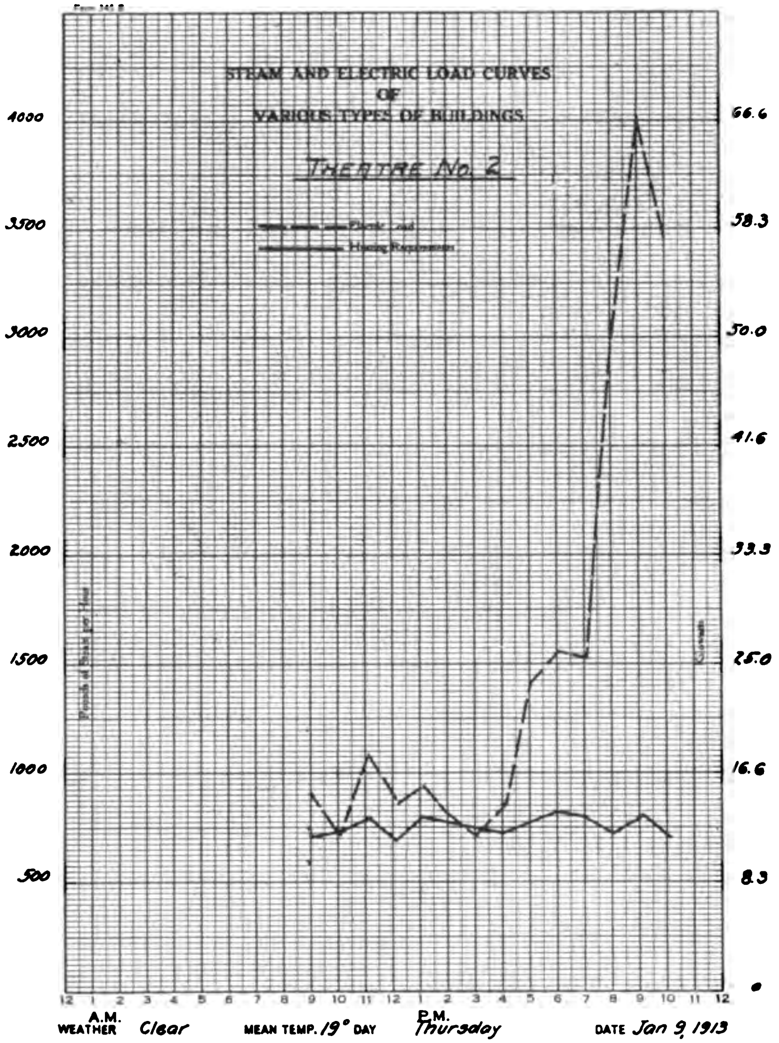


DIAGRAM 9

Diagram No. 10 shows the steam and electrical requirements of a large hotel in St. Paul, on a typical winter day. This is a 12-story building, of tile and steel construction, having cubical contents of 2,308,270 cu. ft. It will be noted that the heating loads in this building are fairly uniform and that the steam required for the electrical load is not only variable, but runs far in excess of the steam used for heating.

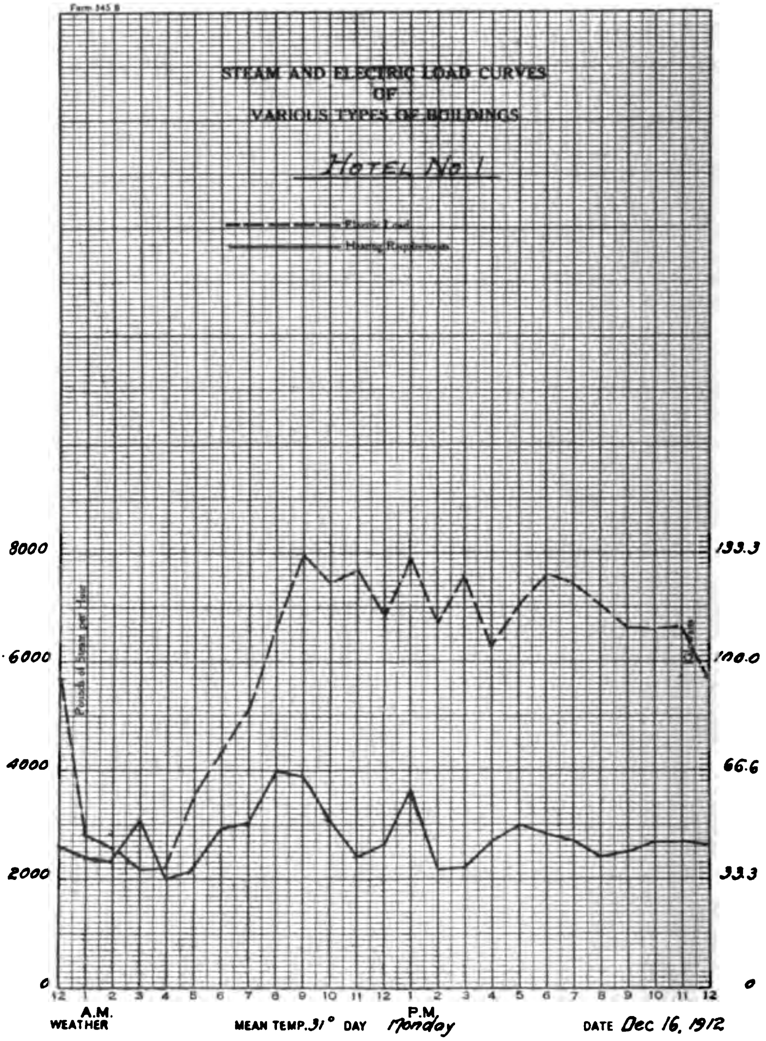


DIAGRAM 10

Diagram No. 11 shows the steam and electrical requirements in a printing shop in Detroit. This is a 5-story brick building,

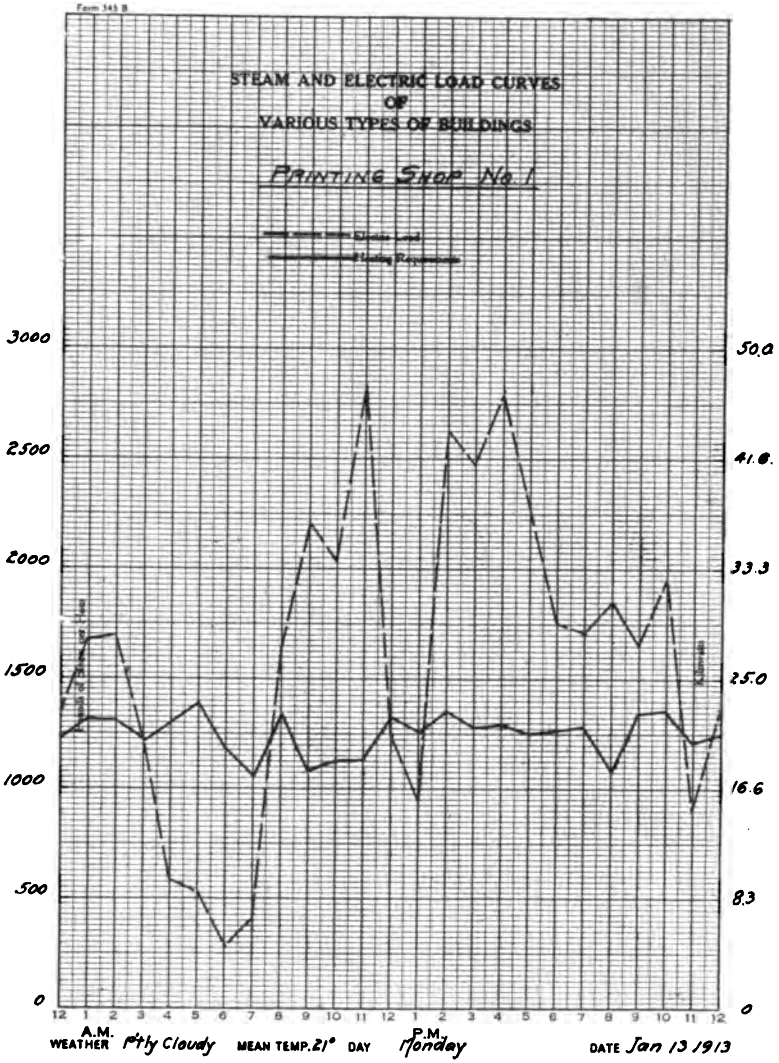


DIAGRAM II

having cubical contents of 315,000 cu. ft. and a connected steam radiation of 4008 sq. ft. The hours for this shop are 7.30 A. M. to 5.15 P. M. There is also a night shift with regular hours.

Diagram No. 12 represents a printing shop in St. Paul. It is a 4-story brick building, having cubical contents of 695,320 cu. ft. and connected radiation of 9529 sq. ft. This is a publishing and printing house, and the hours for the night shift are irregular. It will be noted that the electrical load is used principally in the daytime.

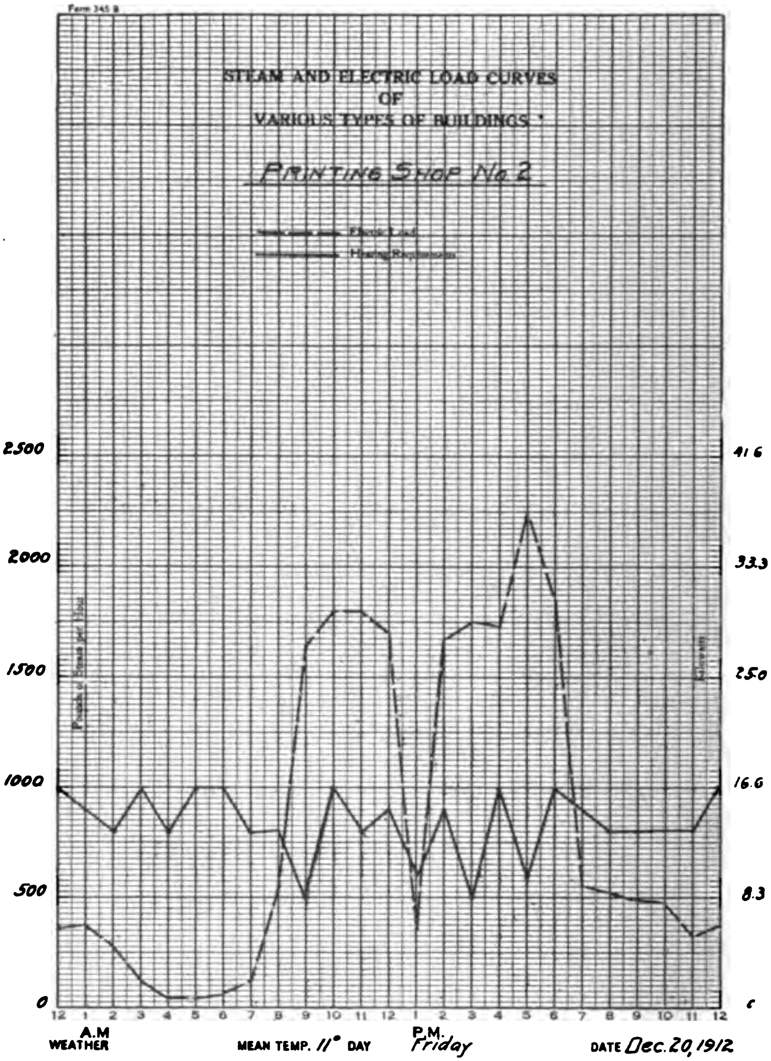


DIAGRAM 12

Quite a large number of additional curves were prepared by the various members of the Committee, which have been omitted for want of space, only a few typical cases having been included in the report. In addition to the curves showing the winter requirements, the Committee prepared a number of curves showing conditions during periods of moderate temperature, but in view of the limitations of this paper it is impracticable to give the variation of these curves from summer to winter. It will be noted, however, that in diagrams No. 2 to No. 4 inclusive, we have given three typical curves of one department store, showing the load under varying conditions. It would have been interesting to have curves for every month of the year, and these curves are being prepared, but it will be sufficient for our purpose to give a few typical cases.

These curves are very instructive, showing as they do that even in the winter time, when the heating and power requirements more nearly approach each other, there is still a wide variation in the two curves, some showing that at certain periods of the day the demand for steam for heating is far in excess of the demand for electricity, while at other periods of the day the demand for electricity is far in excess of the demand for heating. In view of the fact that the steam demand for heating disappears altogether in the summer, and in the winter is not at all coincident with the demand for electricity, it is readily seen that the utilization of exhaust steam for heating in isolated plants is not nearly as great a factor in economy as has sometimes been claimed. It is also shown that there is considerable variation between different buildings, the lack of co-ordination being much more marked in some than in others.

But some isolated plant enthusiast may say, "Here is just what we have been contending all along. Almost every diagram shows that during winter weather a large part of the heat for a building is supplied by exhaust steam." The question is not, however, whether heating can be done economically in this way, but whether the entire plant can be operated economically. In the most modern buildings the heating load constitutes a comparatively small part of the total requirements of the building. The charts show that even in the winter a large portion of the exhaust is necessarily passing to the outer air. This may readily be observed from the top of any high building, since the buildings operating isolated plants can usually be identified by the cloud of steam hovering above their chimneys or exhaust heads.

When we average this curve with the curve for the summer load, it will be seen that an isolated plant would produce a large amount of steam for electrical energy uneconomically in order to make a comparatively small economy along the line of steam heating. In other words, in attempting to secure a small economy we lose sight of a greater economy.

Where steam is bought on a meter basis, and as a result reasonable economy is practiced in its use, we have found from experience that the total annual bills for steam heating in the largest sized office buildings average about one-third the annual cost of operating and maintaining an independent isolated plant. Accordingly, a large percentage of saving in the cost of steam heating is a relatively small factor in the total cost of operating and maintaining a plant.

Referring to diagrams Nos. 2, 3 and 4, showing a department store in Chicago, it will be seen that this particular store makes an especially favorable showing for central-station service as far as the possibilities of a private electric lighting plant are concerned, in view of the fact that there are a number of pumps and elevators which are now operated by steam. In spite of the saving by the use of exhaust steam, the management expects, in the near future, to change their elevators to straight electric elevators, the saving by the use of exhaust steam in the winter being offset by the superior economy of electrically driven machines throughout the year. As in this case, it is often advisable to disregard the saving by the use of exhaust steam for heating in order to secure greater economy in operation by the use of electric units operated by central-station service.

While it has been found that in individual plants there is a lack of co-ordination between steam and electric load curves, it has been suggested that this would not be the case if the dynamos of an isolated plant were used to deliver current to the central-station system of supply. According to this arrangement, the engineer of the plant could regulate the load on his dynamos so as to deliver at all times the required amount of exhaust steam to his heating system.

The Union Light & Power Co., of St. Louis, has tried this scheme in several cases in St. Louis plants. The only cases where dynamos are operated are where they are already installed, hence, there is no additional investment for dynamos and engines. In all other cases they operate the boilers for heating only, the buildings being heated by live steam. In five or six buildings they have been operating dynamos previously installed only at such times as exhaust steam is needed for heating, and the load on the dynamos is made to give just the amount of exhaust steam required for heating. Wherever there is a surplus output from the dynamos, it is fed directly into the central-station system. It has not been found at all practical to operate the dynamos beyond the heating load, as the coal cost brings the cost of electricity per unit far beyond that of the central station. Even when the exhaust steam is used for heating it has not proved economical, as the cost of operating the dynamos, even under these circumstances, has been found to be more than the cost of generating current in the central station. The main argument for this arrangement is a theoretical saving in investment cost, but it has been found that in practice the amount of saving thus made is negligible.

The larger power stations of to-day are installing units of not less than 10,000-kw. capacity. Accordingly, it would make practically no difference in the installation of additional units, whether a few 50 or 100-kw. plants were connected with the station or not.

The Rochester Railway & Light Co. has two small plants which they have planned to operate along the same lines, using them during the peak load of the central station. They state, however, that thus far it has not been economical for them to operate these dynamos to any extent, the total output of the two plants last year being only 230,000 kw-hr., an amount which is hardly worth considering in comparison with the output of a large central station.

In Chicago this question has been taken up very carefully during the past year, with a view to determining whether there would be economy in operating some large dynamos already installed in a building which came into the possession of the central-station company. After determining with great care the cost of operating dynamos during the heating season, it was found to be more economical to dispense with the dynamos and use the boiler plant simply for heating the building. The amount of electricity which could be produced in connection with exhaust steam was not enough to compensate for the extra expense of additional labor for the care of the dynamos and additional expense for the maintenance of an electric generating plant. This conclusion was arrived at both from the fact that the maximum demand for electricity seldom coincides with the maximum demand for heating, and the fact that the central-station investment cost would not be materially reduced by the operation of a few small isolated plants.

Years ago there were men who, even in large cities like New York and Chicago, advocated that central-station plants be located in the heart of the city, and be installed with non-condensing engines so that exhaust steam could be transmitted through the streets for the heating of buildings. Experience has demonstrated the fallacy of this suggestion and the most modern practice demands that large generating plants be installed just outside the crowded districts, where condensing water is available and where the business of power production can be carried on with the highest efficiency.

The cooling of steam in a condenser seems at first sight a waste of energy, just as the heating of buildings by live steam seems at first sight a waste of energy. On the other hand, by maintaining our power station independently for the production of power, and our heating station independently for the production of heat, we have simplified the process in each with the result of increased economy. Every engineer knows that the most economical plant, particularly in small sized units, is not always that which can produce the greatest number of pounds of steam from a pound of coal. It is always necessary to strike a golden mean between increased investment for devices of efficiency and decreased efficiency due to simplicity in construction. In other words, the highest type of engineering will secure the greatest net return for a given expenditure of money.

We do not mean to say that where, for other reasons, non-condensing plants have been installed by central stations it is not advisable to use exhaust steam from them for heating buildings. There is, without doubt, economy in this proceeding, but the highest economy is secured where this incidental economy is overlooked and the two processes are carried out on a large scale independently, neither process being complicated by the limitations inherent in the other.

There are some who may be inclined to doubt this last statement, especially those who have grown eloquent in the past over the principal argument for the isolated plant; namely, the use of exhaust steam for heating. The statement, however, is based on careful investigation. The actual cost of operating dynamos in the six St. Louis plants previously referred to was carefully computed, also the unit cost per kw-hr. on the basis that 10 per cent of the steam for running the engines was chargeable to generation of electricity. This cost was compared with the unit cost per kw-hr. of producing electricity in large central stations like those in St. Louis or Chicago.

In addition to this, the problem was studied from the point of reserve capacity to be used at the time of the peak load of the central station. Figures were carefully made out as to the actual primary charge that would be allowed for dynamos located in the heart of the business district. Figures were also made as to the cost of maintaining these dynamos and supplying efficient labor to operate them at the time of the maximum station load. These figures were worked up not in order to prove a theory, but to discover, if possible, an additional economy for central-station practice.

In making this investigation, it was figured that the increases in capacity in large central stations for a city like Chicago would be in units of not less than 20,000 kw. capacity. In order to affect the decision as to the installation of additional electric units, it would be necessary to have from 10,000 to 20,000 kw. capacity available from outside plants. Thus far, none of the heating companies, or companies operating decentralized plants, have any such amount available. Accordingly, for the time being, the saving would be theoretical only.

In conclusion, the Committee would say that this is a subject which has many different angles and is worthy of the most careful consideration before a decision is made. Especially is it a subject on which it is necessary to procure ample data based on tests which show exact conditions before sweeping generalities may be attempted. The tests we have made thus far seem to warrant us in the conclusions just stated. At the same time, some new phase of the subject may present itself in the future which would tend to modify these conclusions.

Committee	S. MORGAN BUSHNELL, *Chairman*, DAVIS S. BOYDEN, E. F. TWEEDY, A. D. SPENCER, THOMAS DONOHUE, J. L. HECHT, EUGENE HOLCOMB, C. F. OEHLMANN, H. P. PITTS.

Exhibit A

REPORT OF STEAM CONSUMPTION IN A TANNERY

The attached schedule shows the steam consumption in a tannery, as submitted to the Committee by Mr. Hecht, of the Public Service Co. of Northern Illinois. The amount of steam consumed by the paddle vats, lime vats, revolving drums and iron plate on press, was determined by means of six tests on the first named and four tests on the other three. Steam consumed by the balance of the apparatus was estimated on the basis of known data. The tests were made with a Gebhardt steam flow meter, which shows the rate of flow of steam in pounds per hour at a given pressure.

Steam is furnished at a pressure of about 55 pounds. A part of this steam is used in coils with which the building is heated, and which are used in connection with a fan which forces the circulation of heated air. The industrial uses of the steam are to heat water for the different processes and the coils for drying purposes. In most of these, the condensation is absorbed in the process, but in one it is collected into a boiler and gives distilled water for general washing purposes.

The application of steam to many of the units is intermittent and the total use of the unit per working day is shown on the chart. The periods of actual use vary from 5 to 15 minutes each.

The hides are handled in batches of 600 and one batch occupies a day in the process. They are also tied, end to end, in

3 lots of 200 each, and passed through the vats by revolving wheels.

The water in the lime vats is heated to about 75 deg. and here the process begins. Then as the water cools to about 50 deg. it is re-heated to 75 deg. In the last one of the 10 vats the temperature range is from 75 to 100 deg. The other 9 are in 3 sets.

After washing and scraping, the hides are delivered to the paddle vats. These are in 2 sets of 2 each, and the temperature of the acid bath is kept at about 80 deg. by the intermittent application of steam.

The next step is the revolving drums. Here the hides are washed in one, treated in another, and colored in a third. While in service, the temperature is maintained at about 130 deg. by the same re-heating system, as already outlined.

From the drums the skins go through various stages which do not require special heat, and are later delivered to the hot press, where they are glazed. This plate has a surface of about 9 sq. ft. and is heated by a 1-inch steam coil of 9 sq. ft. radiating surface. The temperature of this is kept constant at about 150 deg. and the condensation here was measured.

The hair is washed in a barrel of about 90-gal. capacity, in water at a temperature of 130 deg. This is in operation more than some of the other barrels, but the meter test was not applied. The hair dryer is a pipe coil from which heated air is blown through the hair. This was not in operation at the time, so that a test was not made.

EXHIBIT A

STEAM CONSUMPTION IN A TANNERY

Name of Machine	Number of Machines	Temperature of water before steam enters	Temperature of water when steam is shut off	Time needed to raise to required temp.	Average lb. of steam per machine per hour	Length of service per day in hours
Lime vats	10 (3 sets and 1)	50° in 9 76° " 1	75° in 9 100° " 1	10 min.	697 per set of 3	1
Paddle vats	4 (2 prs.)	68°	80°	10 min.	448 per vat	4
Revolving drums	6	100°	130°	20 min.	531 each	3
Iron plate on press	1	Uniform 150°	Temperature		100	12
Hair dryer	1				200 (estimated)	7½
Tank	1	85°	92°		100 (estimated)	½
Soap barrel	1	40°-50°	210°		75 (estimated)	1
Soda barrels	6	50°	130°		40 each (estimated)	½ each
Water barrels	27	60°	100°-160°		50 each (estimated)	½ each
Water barrel	1	50°	130°		200 (estimated)	7

Name of machine	Sq. ft. of heating surface	Purpose of machine	Condensation loss or gain	Capacity in gallons	Remarks
Lime vats		Removes hair	Absorbed in the process	800 per vat	Tests made on two sets of 3
Paddle vats		A tanning process	Absorbed in the process	1000 per vat	Tests made on one vat
Revolving drums		Tanning, coloring, washing	Absorbed in the process	800 per drum	Tests made on each drum
Iron plate on press	9 in. coil, plate is 2½ ft. by 3½ ft.	Finishing	Discharged to creek		Condensation measured 12 gal. per hr. Avg. temp. water 142° Condensation used for general washing
Hair dryer	500 pipe coil	Hair drying	Returned to old boiler		
Tank		Soaking leather	Absorbed in the process	1200	Line pressure too low for test
Soap barrel		General washing purposes	Absorbed in the process	15	
Soda barrels		General washing purposes	Absorbed in the process	15 each	
Water barrels		General washing purposes	Absorbed in the process	40 each	
Water barrel		Hair washing	Absorbed in the process	90	

EXHIBIT B

Table Showing the Use of Steam by Restaurants in Boston, Mass.

Character of restaurant	Cooking or warming apparatus	Dimensions or capacity	Pounds of steam used per day	Approximate number of persons fed per day	Approximate number of lb. steam per day per person fed
High-class restaurant in office building	12 Coffee and hot-water urns		6164	1146	5.38
	2 Bread warmers				
	3 Dish warmers				
	4 Bain maries				
	4 Jacketed kettles				
	2 Hot-water heaters				
	1 Veg. cooker				
	1 Dish washer				
	1 Silver washer				
Kitchen in high-class apartment hotel	1 Oven	½ in. connection	5960 (a)	500	11.9
	1 Pudding steamer				
	1 Jacketed kettle	16 in. dia.			
	2 Veg. steamers	20 in. by 26 in. by 16 in.			
	1 Stock kettle				
	1 Dish warmer	6 ft. by 3 ft. by 3 ft.			
	2 Dish warmers	6 ft. by 2 ft. by 3 ft.			
	1 Dish warmer	4 ft. by 2 ft. by 3 ft.			
	1 Bain marie	36 in. by 42 in.			
	1 Steam table	2 ft. by 10 ft.			
	1 Silver warmer	3 ft. by 1 ft. by 3 ft.			
	1 Hot-water urn	20 gal.			
	1 Coffee urn	15 gal.			

(a) Does not include hot water.

TABLE SHOWING THE USE OF STEAM BY RESTAURANTS IN NEW YORK CITY

Character of restaurant		Cooking or warming apparatus	Dimensions or capacity	* Pounds of steam used per day	Approximate number of persons fed per day	Approximate number of lbs. steam per day per person fed
Buffet lunch room in downtown office building	2	Kettles	12 in. dia., 6 in. deep	3978	600	6.6
Club restaurant in downtown office building	2	Stock pots	22 in. by 22 in.	7633	500-600	14
	3	Kettles	20 in. by 28 in. by 14 in.			
	2	Urns	22 in. dia., 30 in. deep.			
	1	Urn	22 in. dia., 38 in. deep.			
	1	Bain marie	22 in. by 57 in.			
	1	Bain marie	30 in. by 50 in.			
	1	Dish washer	2 Basins			
	4	Plate warmers	57 in. by 22 in. by 22 in.			
Club restaurant in downtown office building	1	Soup kettle	60 gal.	8124	800	10
	1	Kettle	18 in. dia.			
	2	Bain maries	30 in. by 24 in. by 12 in.			
	2	Steam tables	36 in. by 36 in. by 8 in.			
	2	Dish washers	18 in. dia.			
	1	Plate warmer	24 in. by 60 in. by 72 in.			
	2	Coffee urns	7 and 5 gal.			
	2	Tea urns	1 gal. each			
	1	Steam table	24 in. by 96 in. by 5 in.			
	3	Coffee urns	5 gal. each			
Restaurant in large club house	1	Iron kettle	50 gal.	5880	500-600	10
	1	Kettle	50 "			
	1	"	40 "			
	1	"	15 "			
	2	Dish washers	4 Basins			
	12	Plate warmers				
	1	Egg boiler	3 compartments			
	4	Veg. steamers	6 in. by 24 in. by 12 in.			
	1	Steam table	20 ft. by 3 ft.			
	3	Coffee urns	12 gal. each			
Restaurant in apartment hotel	1	Plate warmer	60 in. by 36 in. by 24 in.	1000	330	3
High-class restaurant in downtown office building	1	Kettle	42 in. by 24 in. deep	11900	800-900	14
	1	Stock pot	24 in. by 24 in.			
	2	Boilers	24 in. by 20 in. deep.			
	1	Steamer	18 in. by 24 in. by 18 in.			
	1	Plate warmer	24 in. by 48 in. by 36 in.			
	2	Hot-water urns	17 gal.			
	1	Steam table	180 in. by 48 in.			
	3	Coffee urns	8 gal.			
High-class restaurant in downtown office building	1	5 T. refrig. mach.		2,600,000 per year		
	1	Hot-water heater	60 in. by 60 in.			
	1	Steam table	72 in. by 30 in.			
	1	Kettle	10 in. dia.			
	1	Boiler	24 in. by 18 in. by 24 in.			
	1	Dish washer				

All results for restaurants in New York City are based on periods of tests of one day except the second, which was five days, and the last, which was one year.

TABLE SHOWING THE USE OF STEAM BY RESTAURANTS IN CHICAGO, ILL.

BASED ON MONTHLY METER READINGS

Character of restaurant	Cooking or warming apparatus	Dimensions or capacity	Pounds of steam used per day	Approximate number of persons fed per day	Approximate number of lbs. steam per day per person fed
Cafeteria or lunch club	3 Urns	10 gal.	3300	800-1000	3.66
	1 Bain marie	24 in. by 24 ft.			
	1 Veg. steamer	16 in. by 24 in. by 12 in.			
	1 Plate warmer				
	1 Hot-water heater	24 in. by 60 in.			
Dairy lunch	3 Urns	10 gal.	3660	1000	3.66
	2 Bain maries	18 in. by 84 in.			
	1 Dish washer	Open jets			
	1 Hot-water heater				
Cafeteria or lunch club	4 Urns	10 gal.	5550	1200-1400	5.27
	2 Bain maries	24 in. by 20 ft.			
	2 Plate warmers	24 in. by 36 in. by 36 in.			
	1 Roll warmer	36 in. by 48 in. by 72 in.			
	1 Hot-water heater	24 in. by 48 in.			
	2 Dish washers	Open jets			
	2 Bread warmers				
Counter lunch room	6 Urns	15 gal.	3300	2000	1.65
	1 Bain marie	24 in. by 60 in.			
	1 Jacketed kettle	5 gal.			
	2 Urns	4 "			
	1 Bean warmer	12 in. by 12 in. by 16 in.			
	1 Hot-water heater	24 in. by 72 in.			
High-class Chinese-American restaurant	2 Urns	10 gal.	3500	500	7.0
	1 Bain marie	24 in. by 9 ft.			
	1 " "	24 in. by 7 ft.			
	2 Plate warmers	12 in. by 48 in. by 8 ft.			
	1 Hot-water heater				
Highest-class restaurant	2 Steam tables	36 in. by 48 in.	20000	1000	20.0
	1 Bain marie	24 in. by 48 in. by 72 in.			
	1 Plate warmer	12 in. by 36 in. by 21 ft.			
	3 Plate warmers	72 in. by 36 in. by 18 in.			
	1 Cup warmer	18 in. by 48 in. by 48 in.			
	3 Urns	12 gal.			
	1 Jacketed kettle	36 in. dia.			
	3 Veg. steamers	24 in. by 36 in. by 12 in.			
	1 Veg. cooker	24 in. by 36 in. by 48 in.			
	4 Open jets in sinks				
	6 Oyster pots	5 in. dia.			
	1 Egg boiler				
	1 Lobster steamer	12 in. dia.			
	2 Grease kettles	36 in. dia.			
	1 Dish washer				
	1 Milk tester				
	1 Hot-water heater	36 in. by 72 in.			

TABLE SHOWING THE USE OF STEAM BY RESTAURANTS AND FOR WARMING APPARATUS IN THE CITY OF DETROIT, MICH.

Character of restaurant	Cooking or warming apparatus	Dimensions or capacity	Pounds of steam used per day	Hours used per day	Seating capacity	Period of test
Low-price restaurant	1 Steam table	10 in by 2 ft. 8 in. by 6 in.	3015	24	144	68 days
Cafe and restaurant in second-class hotel	1 Steam table 2 Steam tables 1 Plate warmer	10 ft. 6 in. by 2 ft. 3 in. by 6 in. 36 in. by 27 in. by 8 in. 4 shelves—4 ft. by 20 in., 18 sq. ft. radiation	2330	11	178	143 days
Drug store lunch counter, serves noon lunch	1 Steam table	10 ft. by 3 ft. by 4 in.	126	4	Counter seats 26 persons	56 days
Newspaper printing shop	2 Steam tables for drying the paper impressions	3 ft. by 3 ft. by 4 in.	1007	There are 4 editions of paper daily		59 days

THE CHAIRMAN: The report is now open for discussion, gentlemen. This is a subject that affects more companies in large cities than in small, although there are some notable installations in smaller communities.

DISCUSSION

MR. W. R. COLLIER, Atlanta, Ga.: I think in this report we have data which will be of the greatest value to all of us in fighting the isolated plant. I speak particularly from my own experience along this line. We are operating in Atlanta a district steam-heating system. When we started this system we were operating and obtaining all of our electric power from steam generating units. We made a flat rate for steam heating, based upon the number of square feet of radiation installed, which, I might say, we later found was a mistake. After we had been operating on the flat rate for about four years, we found that there was such a waste of steam that we began looking around to see if we could get a good steam meter and a fair steam meter rate. We think we found both a good rate and a good meter, and we are now getting on an average about 43 cents per thousand pounds of condensed steam as revenue. We now supply all of our electric customers from our hydro-electric plants. This means that the coming season we shall either have to take care of our steam-heating customers with live steam or to run steam electric units and possibly lose a considerable amount of water over the dam in order to supply our steam customers with exhaust steam. We have not had a chance to figure out whether there would be any profit in this scheme, due to the fact that the pressure varies greatly on our steam-heating system. In Atlanta, the temperature is not at all regular, consequently, the steam pressure on our heating mains is also very irregular, running from less than a pound up to about 15 pounds. Of course, when we go into pressures above four or five pounds, we are obliged to use live steam, and I do not think we can make any profit in the steam-heating business if we have to keep up such pressures. I can sum up the success we have had thus far by saying that in Atlanta we now have only six large isolated plants operating in the central part of the town. This is a town of approximately 200,000 population.

Mr. Leon H. Scherck, Poughkeepsie, N. Y.: There is a suggestion on Page 11 of the Report that is pretty good, and that is to adopt a sliding-scale rate. By all means let us get away from the flat rate. I have had some experience in the Southern States and am now operating a small steam-heating station. We have found that by the introduction of an equitable system of meter rates the customer really saves money over the flat rate and at the same time the company saves money. In other words, the waste is eliminated. It is necessary, however, in making up rates, to be very careful to get in all the factors. The tendency has been to make the price too low on the meter basis. There is a peculiar condition that comes in. If the season is a mild one, your income from the steam service is small and your losses remain nearly the same. The question of your ability to connect up hydro-electric systems must be considered. We have a condition similar to that of which the gentleman from Atlanta has spoken. We acquired this steam-heating station and it was all right when run as an electric generating station, but we can now get energy cheaper by water-power connection than we can by selling steam as a by-product. However, heating service is one of those things which once established must be kept up, even if it is run without profit. I think the advantages accruing from our ability to keep isolated plants out of the field are well worth the trouble.

Mr. Bolton, Aledo, Ill.: I fail to understand why there should exist any question in regard to the financial success of the heating proposition if the conditions are suitable, and any one with reasonable engineering capacity should be able to determine this. We have, for several years, been operating at Aledo, Ill., a plant which is located about 1000 feet from the center of steam distribution, and we also pump the city water. By careful manipulation, we are able to throw the exhaust steam from the pumps into the heating mains at the time of day when heat is most required. The past year I have not yet checked up, but I can say that during the winter of 1911 we collected from exhaust steam alone, something over $4,000. If any one wishes to write to me, I will give the exact figures, but I can say with confidence that our heating system will more than pay for the coal we use. I am sure that proper installation will enable a person to successfully manipulate a steam-heating plant, using the exhaust steam system. It seems to me that this by-product, which we might call our back-pressure, is certainly a most valuable asset. In the ordering of our plant we secured a very cheap and a very economical installation. Our merchants permitted us to run the steam lines under their buildings and all the buildings were properly provided with subways, so that the cost of the original installation was very small, indeed. All the insulation that was needed was a thorough covering of magnesia. If you would care to visit us at Aledo, we can show you an installation which has been a positive financial success and one where exhaust steam is used exclusively.

MR. E. F. MCCABE, Titusville, Pa.: We are operating in a town of about 15,000 people in New York State. We have about 4½ miles of steam mains laid. We have 250 customers and about $100,000 invested in steam mains and auxiliaries. Our revenue for 1912 was $23,000; our coal bill for the same period was $26,000, but we carry a back pressure of about five pounds during the heating season. Referring to the remarks of the gentleman from Aledo, we had some mains installed in the cellars of buildings just as he has, one of which was a hotel. Some time last fall the company which controlled this property before we got it, put in meters. Previous to that time they sold steam on a flat rate. When the meters were installed, of course the bills were very largely increased, sometimes as much as three times what the customer had been paying. This hotel I refer to, took exception to the change and demanded that we give them a flat rate of $25 per month or take the pipes out of the cellar.

MR. BOLTON: I would like to say that the only difficulty was that Mr. McCabe did not get a proper contract to begin with. I had a very careful lawyer draw the contracts for locating these mains in the basements and I challenge any man in Aledo to get one of them out.

MR. SCHERCK: I think the name of the town should be Utopia. I am sure there are certain advantages in steam-heating systems, but I am wondering if the gentleman figured his investment charges and the other things that go with them. If he did, and is able to make such a profit, I certainly want to have the pleasure of visiting his town.

Mr. Bolton: In response to the gentleman's statement. I will say that if he comes I will show him a plant in which the initial cost of the installation was very small, due to the fact that we were not obliged to go through the streets; otherwise I do not believe it would have been so much of a success. The ease with which the mains were installed and the ability to get at them count for much, and we have not had the slightest murmur from any of our patrons in regard to the presence of these mains in their cellars. The line has been installed by competent engineers. We heat practically the entire commercial district. This district was formerly heated by steam boilers owned by the men who owned the buildings, and so satisfied are these gentlemen that we have not lost a single patron. The exact number of customers I am unable to mention, due to the fact that four or five of the buildings are owned by the same man and the heating is subdivided into a dozen different accounts.

Mr. Scherck: What is the population and the rate?

Mr. Bolton: The population is 3000, the rate, $4.00 per thousand cubic feet per annum. The meter rate is 40 cents per thousand pounds.

The Chairman: I will ask Mr. Bushnell to close the discussion on this paper.

Mr. Bushnell: Mr. Chairman, I do not believe that I have anything further to say.

The Chairman: I will call on Mr. Burnett to read the Report of the Committee on the Address of the Chairman.

REPORT OF THE COMMITTEE ON THE ADDRESS OF THE CHAIRMAN

The address of our Chairman is, this year, very comprehensive in scope, covering as it does the entire activities of our Commercial Section and the main points of active interest in commercial work to-day.

Your Committee feels that this means should be taken to record the success attained by our Chairman in intuitively and introspectively discerning the present-day needs of the business and of the membership of the Section in commercial work—in promptly appointing committees to investigate and report on matters of current interest that require attention—and in securing the co-operation and support of the committeemen, with the result that we have before us that splendid series of papers and reports that constitute the matter before our Convention for discussion, and that have provoked a most interesting series of talks by delegates on the floor. The fact that it has been necessary to cut short many discussions on the floor shows the intense interest that has been aroused at our meetings.

It seems unnecessary to discuss in detail the various statements of the Chairman as to the work of our committees, because the Executive Committee of the Section is the machinery that has been provided for working out these details. However, we do earnestly recommend this report of our Chairman to the incoming administration of the Section for careful consideration to the end that the good work accomplished this year may be carried on under a continuous policy and the committees for next year do good constructive work on seasonable subjects and timely matters.

The Commercial Section exists for the purpose of promoting the interests of us all as commercial men and will be of the greatest value when the work of our Section is useful alike to both the large company and the small, to the commercial manager and to the salesman in the street, the saleswoman at the application or appliance counter, the man who attends the Convention and the one who stays on the job. We feel that the work of this year has acomplished this and look forward with confidence to the carrying out of this purpose in next year's program.

Respectfully submitted,

Committee DOUGLASS BURNETT, *Chairman*
FRANK H. GALE
M. C. OSBORNE

(It was moved, seconded and voted that the Report on the Address of the Chairman be accepted.)

THE CHAIRMAN: We will next have the Report of the Nominating Committee for the Officers and Executive Committee of the Commercial Session for next year.

The Report of the Nominating Committee was then filed as follows:

REPORT OF THE NOMINATING COMMITTEE

FOR OFFICERS

Chairman,	T. I. Jones
Vice-Chairman,	E. L. Callahan
Vice-Chairman,	Douglass Burnett
Secretary,	J. F. Becker
Assistant Secretary,	Miss G. Burkhalter

FOR MEMBERS OF THE EXECUTIVE COMMITTEE OF THE COMMERCIAL SESSION

E. W. Lloyd, Chicago
T. I. Jones, Brooklyn
Douglass Burnett, Baltimore
J. F. Becker, New York
E. L. Callahan, Chicago
C. A. Littlefield, New York
J. C. McQuiston, Pittsburgh
F. H. Gale, Schenectady
F. B. Rae, New York
H. J. Gille, Seattle
H. M. McConnell, New York
L. R. Wallis, Boston
W. R. Collier, Atlanta
J. Israel, Philadelphia
B. L. Gaskell, Greenville, O.
N. H. Boynton, Cleveland

W. B. Robertson, Buffalo
(Or an alternate to be named by the Electrical Jobbers' Association)

Ernest McLeary, Detroit
(or an alternate to be named by the Electrical Contractors' Association)

Respectfully submitted,

Committee
John G. Learned
J. Robert Crouse
M. C. Osborne

Mr. M. S. Seelman, Jr., Brooklyn: I move the usual course be taken and that the Secretary cast one ballot for the officers named by the Nominating Committee.

(The motion was duly seconded and carried.)

The Chairman: Please take the chair, Mr. Jones, and let us hear what you are going to do next year.

Mr. Jones: I think I have talked almost enough in this Convention, but there is one thing I would like to say and that is that the Convention should be merely an incident in Commercial Section work. I think the average man who goes to a Convention feels that it makes a fine outing, and when it is over goes back to his bailiwick and forgets that something should follow. That is not the purpose of the Commercial Section as it was organized by enthusiastic commercial men in St. Louis. If the Commercial Section means anything at all it means constant work in getting information and passing it on to men who are in the field.

It is not generally known that the Section maintains a salaried force at the National headquarters in New York for the disbursement of information on commercial subjects. I should like to feel that any commercial man in the country may address the Secretary or myself on any commercial problem with which he is in need of assistance, and learn what has been done toward solving it in other parts of the country.

I cannot feel that my duty consists in merely attending the meeting of the Executive Committee of the Section. If any of you, not members of that Committee, have anything to offer on the operation of this Section, if you have any ideas to be brought up at the next Convention, if you have anything at all of interest to the commercial end of our business, I shall deem it a very great pleasure to hear from you along those lines.

I thank you.

The Chairman: Before adjourning this meeting I want to take the opportunity of again thanking the members of the Executive Committee and those who have helped in the preparation of the program for this year. The work covered has been a severe call on the time of some of the members of these committees. I have read, myself, carefully almost all of the Reports, and I want to say to you that the information contained in them is extremely valuable, and any man taking these papers home can well afford to study them.

(Adjourned *sine die.*)

EXHIBITORS' INDEX

Adams-Bagnall Electric Co.
American District Steam Co.
American Ironing Machine Co.
Bell Electric Motor Co.
Benjamin Electric Manufacturing Co.
Century Electric Co.
Chicago Fuse Manufacturing Co.
Conlon-Simplex Machine Co.
Co-operative Advertising Service for Central Stations
Cooper Hewitt Electric Co.
Duncan Electric Manufacturing Co.
Duplex Metals Co.
Economical Electric Lamp Works of General Electric Co.
Economy Fuse & Manufacturing Co.
Edison Storage Battery Co.
Electric Appliance Co.
Electric Service Supplies Co.
Electric Storage Battery Co.
Electric Vehicle Association of America
Electrical Review and Western Electrician
Electrical World
Eureka Vacuum Cleaner Co.
Federal Sign System (Electric)
General Electric Co.
General Vehicle Co.
G. & W. Electric Specialty Co.
Hotpoint Electric Heating Co.
Hubbard & Co.
Hughes Electric Heating Co.
Hurley Machine Co.
Innovation Electric Co.
H. W. Johns-Manville Co.
Life-Saving Devices Co.
W. N. Matthews & Bro.
Metropolitan Engineering Co.
Minerallac Electric Co.
Moloney Electric Co.
National Quality Lamp Division of General Electric Co.
National X-Ray Reflector Co.
Oshkosh Manufacturing Co.
Otis Elevator Co.
Philadelphia Electric & Manufacturing Co.
Pittsburgh Transformer Co.
Popular Electricity Magazine

Metropolitan Protective Devices

(MURRAY PATENTS)

FOR THE SAFETY—PROTECTION—CONVENIENCE OF CENTRAL STATIONS

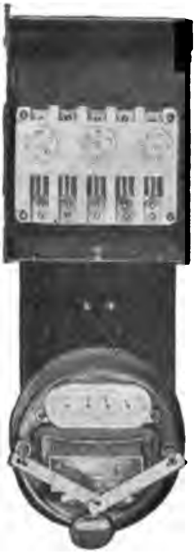


Fig. 1

Figure 1 shows our Type S Protective Service Cutout Box and Meter Adapter applied to a Westinghouse type C Watthour Meter. Cover of box is removed to show Service and Meter Testing Cutout.

Figure 2 shows same device described in figure 1, except that Adapter is for a General Electric Type I Watt-hour Meter. This shows the device with the cover on.

Adapters for use with standard boxes and cutouts are made to fit all makes and types of meters.

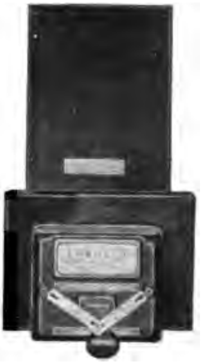


Fig. 2

Metropolitan A-C. Network Protector

This Network Protector, which is shown diagrammatically in figure 3, is designed to instantaneously disconnect a defective transformer, protecting the secondary network by preventing an overload on the remaining transformers and a consequent interruption of the service. It is entirely electrical—positive in action—free from moving parts—requires no attention or adjustment.

Our new loose-leaf catalog, just issued, shows our complete line of Protective Devices.

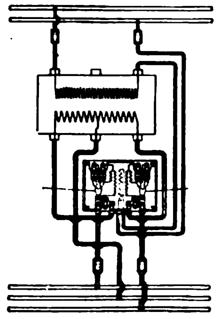


Fig. 3

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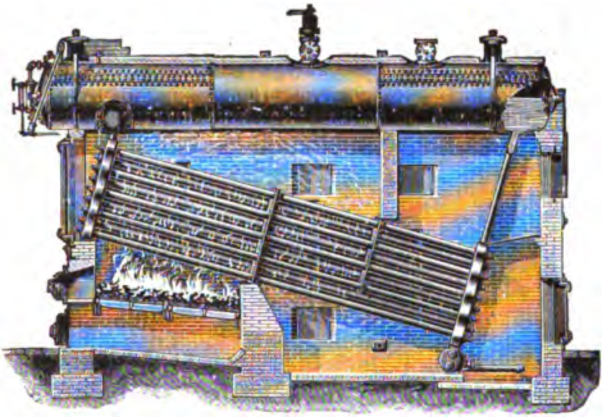

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Havana, Cuba	115 1-2 Calle de la Habana
San Francisco Cal.	99 First Street
Los Angeles,	American Bank Building
New Orleans,	Shubert Arcade
Philadelphia,	No. American Building
Pittsburgh.	Farmers' Deposit Bank Building
Portland, Ore.	Wells Fargo Building
Seattle, Wash.	Mutual Life Building
Salt Lake City	313 Atlas Block

A Paragraph taken from "Scientific American" of May 3, 1913, that will interest Central Stations:

> ***"Many factors enter into the economics of electric power production. For the best economy it is of course desirable that the load be distributed as evenly as possible over the twenty-four hours of the day - - - A breakdown, even of a few moments, in the electric power plant which supplies a large city with current for lighting, running elevators, etc., will not only cause great inconvenience and annoyance, but may, in a crowded theatre, for example, bring panic and disaster in its train."***

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Our organization is ready to co-operate with you in personal sales work or to furnish data and information that will be of assistance to you in extending and increasing the elevator load on your circuits.

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The Meaning of Mazda

The Magi or Magicians, fire worshippers, priests of the Persian god Mazda, in their ritual many thousand years ago, were wont to carry the sacred flame on a salver or tray. Their reputation for learning and wisdom has survived throughout the ages until to-day it appears in our language in the word "magic."

The problem of artificial illumination has always occupied the attention of mankind. The earliest knowledge that we have of the human race centers about a religion in which light and fire and the heavenly bodies were worshipped under the form of a god—Ahura Mazda (Divine Wisdom), whose cult under the prophet Zoroaster and the magicians, became the guiding spirit of civilization for the whole of the then known world.

This dim voice of the remote past is the first known link in a chain of investigation, research and invention which has bound over sixty centuries of mankind, comprising within its folds the history of civilization and ending in the various achievements of modern science. The last link, following the revolutionary discovery of the incandescent electric light by Thomas A. Edison in 1879, has been the perfection of a system of artificial illumination employing the electric current and the Mazda Lamp—a system which offers a solution of the age-long problem of light for everybody.

It is not unfitting that early historic aspiration and endeavor should be joined with present achievement; it is not unfitting that a name should be established in our language for the best light which scientists and manufacturers can produce—a name which shall always denote the most nearly perfect incandescent light nature can offer and man can control—MAZDA.

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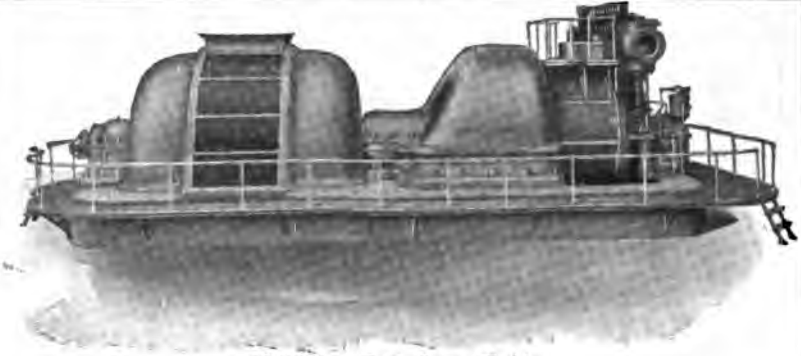

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CURTIS TURBINES
CLOSELY LINKED
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ECONOMY

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CURTIS TURBINES
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RELIABILITY
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SINCE its invention the Curtis Steam Turbine Generator has steadily advanced in economy. The material used in its construction and the mechanical design are the result of years of study and development, supplemented by practical operating experience in the power plants of the world, while constant practice has developed unusual refinements in manufacture—both in workmen's skill and special machinery.

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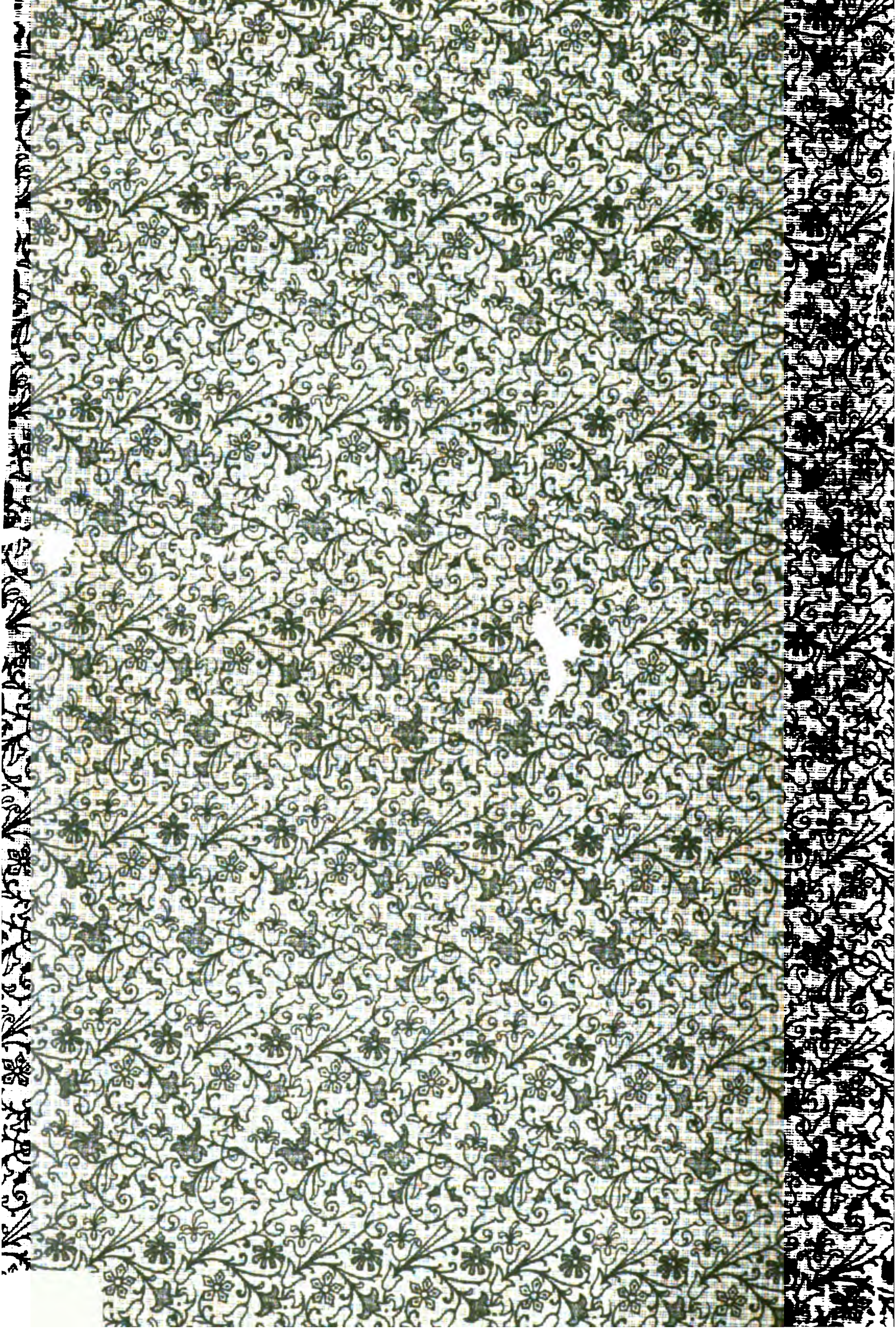

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